INSTRUCTION MANUAL

MODULAR MICROWAVE SIGNAL GENERATORS MODELS 1107E AND 1108E

MODULAR MICROWAVE SIGNAL SOURCES MODELS 1207E AND 1208E

d polarad polarad **polarad** pc

Polarad Electronics, Inc. 5 Delaware Dr. Lake Success N.Y. 11042 Tel: 516-328-1100 TWX: 510-223-0414

DECEMBER 1983

Instrumentation

Warranty

polarad electronics, inc.

We warrant each new instrument to be free of defects in materials and workmanship.

We will service, repair and adjust as required any instrument which proves defective within one year after date of delivery and which is returned to our factory (or other authorized depot) for that purpose.

For warranty information or other assistance, please contact Polarad Customer Service Department in Lake Success, New York, or an authorized regional service depot.

No other warranty is expressed or implied. No liability is assumed for consequential damages.

5 Delaware Drive
Lake Success, New York 11042
516-328-1100
TWX: 510-223-0414

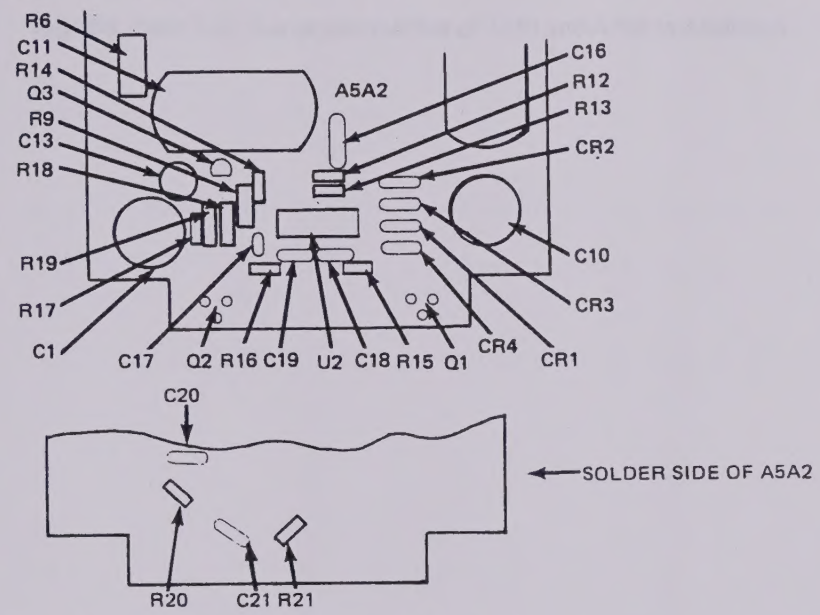
polarad

INSTRUCTION MANUAL CHANGE BULLETIN

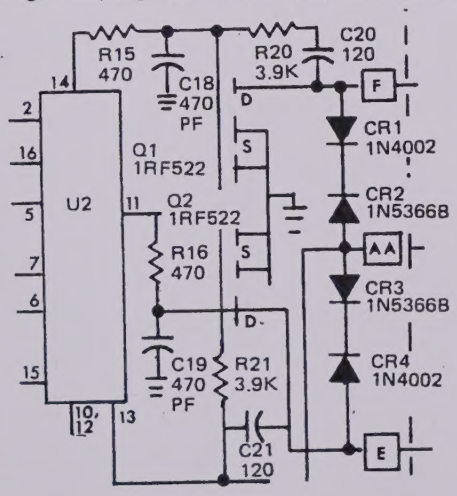
THIS BULLETIN APPLIES TO:

MODEL(S): 1107E, 1108E, 1207E, 1208E
SERIAL NO.: All
ISSUE DATE: May 1985

Page 4-31, Figure 4-13: Add C20, C21, R19, and R20 to A5A2 as shown below:



Page 5-15, Figure 5-7: Add C20, C21, R20, and R21 as shown below:



This bulletin should be carefully examined since it contains information vital for updating this manual and for incorporating changes made after publication date. Bulletins are issued to insure that the manual contains current information and reflects the characteristics of the instrument for which it is intended.

For additional information, please contact Polarad's instrument application specialists for maintenance assistance, or our Customer Service Department.

polarad electronics, inc.

5 Delaware Drive / Lake Success, New York 11040 / 516-328-1100 TWX 510-223-0414

polarad

INSTRUCTION MANUAL CHANGE BULLETIN

THIS BULLETIN APPLIES TO:

MODEL(S): 1107E, 1108E, 1207E, 1208E
SERIAL NO.: All
ISSUE DATE: April 1984

Page 6-9, Table 6-2: Change part number of A7S1 and A7S2 to AN3234-1.

This bulletin should be carefully examined since it contains information vital for updating this manual and for incorporating changes made after publication date. Bulletins are issued to insure that the manual contains current information and reflects the characteristics of the instrument for which it is intended.

For additional information, please contact Polarad's instrument application specialists for maintenance assistance, or our Customer Service Department.

polarad electronics, inc.
5 Delaware Drive / Lake Success, New York 11040 / 516-328-1100 TWX 510-223-0414

polarad

INSTRUCTION MANUAL CHANGE BULLETIN

THIS BULLETIN APPLIES TO:

MODEL(S): 1107E,1108E,1207E,1208E
SERIAL NO.: All
ISSUE DATE: August 1984

Page 6-2, Table 6-1: Delete manufacturers 14099, and 99999, and add the following:

Code	Name and Address
59635	H. V. Components, Inc. Howell, N.J. 07731

Page 6-7, Table 6-2: Change part number of A5A1C12 from "503D107G0" to "503D107M025."

Page 6-7, Table 6-2: Change part number of A5A1CR9 from "SH30F" to "CG3F" and manufacturer's code from "14099" to "59635."

Page 6-8, Table 6-2: Change manufacturer's code of A5A2CR5 from "99999" to "59635."

This bulletin should be carefully examined since it contains information vital for updating this manual and for incorporating changes made after publication date. Bulletins are issued to insure that the manual contains current information and reflects the characteristics of the instrument for which it is intended.

For additional information, please contact Polarad's instrument application specialists for maintenance assistance, or our Customer Service Department.

polarad electronics, inc.

5 Delaware Drive / Lake Success, New York 11040 / 516-328-1100 TWX 510-223-0414

TABLE OF CONTENTS

Paragraph		Page
	SECTION I — INTRODUCTION	
1-1	Scope of Manual	1-1
1-3	Purpose and Use of Instruments	1-1
1-4	Signal Generators, Models 1107E and 1108E	1-1
1-6	Signal Sources, Models 1207E and 1208E	1-1
1-10	General Description	1-1
1-12	Equipment Supplied	1-3
1-14	Equipment Specifications	1-3
1-16	Transistors, Diodes, Integrated Circuits and Klystron Complement	1-3
1-18	Accessories for Polarad Signal Generators and Sources	1-3
	SECTION II — OPERATION	
2-1	General	2-1
2-3	Installation	2-1
2-6	Operating Procedures	2-1
2-8	Operating Controls, Indicators, and Connectors	2-1
2-9	Connection and Preliminary Operation	2-1
2-10	CW Operation (1107E, 1108E, 1207E, 1208E)	2-5
2-11	Internal Square Wave Modulation Operation (1107E, 1207E, 1108E, 1208E)	2-6
2-12	Internal FM Operation (1107E, 1108E, 1207E, 1208E)	2-6
2-13	External FM Operation (Models 1107E, 1108E, 1207E, 1208E)	2-6
2-14	External Pulse/Square Wave Operation	2-6
2-15	Automatic Frequency Stabilization	2-6
2-16	Operation with Other Modular Microwave Instruments	2-6
2-17	Packaging Instructions	2-7
2-18	Packaging for Short Term Storage	2-7
2-19	Packaging for Long Term Storage or Shipment	2-7
2-20	Shut-Down Procedure	2-8
	SECTION III — THEORY OF OPERATION	
3-1	General	3-1
3-4	Block Diagram Analysis	3-1
3-9	Detailed Theory of Operation	3-1
3-10	Klystron Oscillator	3-1
3-14	Mode Switching	3-3
3-15	Repeller Voltage Tracking System	3-3
3-16	Protective Diode	3-3
3-17	Frequency Control Knob	3-3
3-18	Calibrated Attenuation Operation	3-3

TABLE OF CONTENTS (Cont'd)

Paragraph		Page
3-21	Schmitt Trigger and Amplifier	3-4
3-22	Time Delay Circuit	3-4
3-23	Square Wave Generator	3-4
3-24	Modulation Selection	3-4
3-25	RF OFF Position	3-5
3-26	CW Position	3-5
3-27	INT SQ. WAVE Position	3-5
3-28	EXT ⊓⊔ ⊔ Position	3-5
3-29	INT FM Position	3-5
3-30	EXT FM Position	3-5
3-31	ΔF Control	3-5
3-32	Beam (–1250V), Repeller (–1750/–1850V), and the +40V (–1280V) Ground Power Supplies	3-5
3-32A	Low Voltage DC Power Supply	3-5
3-32B	Low Voltage High Frequency AC Voltage Generator	3-5
3-32C	High Voltage – High Frequency AC Voltage	3-6
3-32D	Beam Power Supply	3-6
3-32E	The Repeller Voltage	3-6
3-32F	The +40V Supply for Control Circuits	3-6
3-33	Klystron Filament Supply	3-6
3-34	Power Supply Adjustments	3-6

SECTION IV – MAINTENANCE

4-1	General	4-1
4-3	Test Equipment Required	4-1
4-5	Preliminary Inspection	4-1
4-7	Minimum Performance Standards	4-1
4-9	Troubleshooting	4-1
4-11	Disassemby and Reassembly Instructions	4-1
4-13	Removal of Attenuator Probe Assembly	4-14
4-14	Replacement of Attenuator Probe Assembly	4-14
4-15	Removal of Power Set Probe Assembly (Models 1107E, 1108E Only)	4-14
4-16	Replacement of Power Set Probe Assembly (Models 1107E, 1108E Only)	4-14
4-17	Replacement of Klystron Oscillator Tube V1	4-15
4-18	Adjustment and Calibration Procedures	4-18
4-20	–1250 Volt Adjustment	4-18
4-21	–1750/–1850 Volt Adjustment	4-18
4-22	Beam Current Adjustment	4-18
4-23	Filament Voltage Adjustment	4-19
4-24	INT FM DEV Range Adjustment	4-19
4-25	Klystron Frequency Alignment	4-19
4-26	Repeller Voltage Tracking Adjustment	4-22
4-27	Models 1107E and 1108E Only	4-24
4-28	Power Output Check	4-24
4-29	Final Check	4-24
4-30	Accessory Test Connector	4-24

TABLE OF CONTENTS (Cont'd)

Paragraph		Page
	SECTION V – SCHEMATIC DIAGRAMS	
5-1	General	5-1
	SECTION VI – PARTS LIST	
6-1	Introduction	6-1
6-3	Ordering Information	6-1
6-4	How to Use the Parts List	6-1
6-6	Reference Symbol Column	6-1
6-7	Description Column	6-1
6-8	Manufacturer's Part Number Column	6-1
6-9	Manufacturer's Code Column	6-1
6-10	Maintenance Quantity Column	6-1

LIST OF ILLUSTRATIONS

Figure		Page
1-1	Modular Microwave Signal Generator	vi
1-2	Typical RF Outputs and RF Power Monitor Outputs	1-2
2-1	Models 1107E, 1108E, 1207E, and 1208E. Outline Installation Drawings	2-2
2-2	Operating Controls, Indicators, and Connectors	2-3
2-3	Models 1107E, 1108E, 1207E, and 1208E. Connections for Use	2-5
2-4	Packaging Diagram	2-8
3-1	Modular Microwave Signal Generators/Sources (Models 1107E, 1108E, 1207E, and 1208E) Block Diagram	3-2
3-2	High Voltage Generation, Block Diagram	3-6
4-1	Minimum Performance Standards Test Setups	4-3
4-2	Klystron Cavity, Exploded View (Models 1107E and 1207E)	4-16
4-2A	Klystron Cavity, Exploded View (Models 1108E and 1208E)	4-17
4-3	Test Setup for Klystron Frequency and Repeller Tracking Adjustments	4-19
4-4	Tuning Cam Adjustments	4-21
4-5	Mode Patterns	4-21
4-6	Typical Repeller Voltage Vs. Frequency Characteristics, Models 1107E and 1207E	4-23
4-7	Typical Repeller Voltage Vs. Frequency Characteristics, Models 1108E and 1208E	4-23
4-8	Typical Chassis, Top View.	4-25
4-9	Models 1107E, 1108E, 1207E, and 1208E Chassis, Rear View	4-26
4-10	Models 1107E, 1108E, 1207E, and 1208E Chassis, Side View	4-27
4-11	Pushbutton Board Assembly A3, Component Layout	4-28
4-12	High Voltage Control Board Assembly A4, Component Layout	4-30
4-13	High Voltage Box Assembly A5, Component Layout	4-31
5-1	Model 1107E Modular Microwave Signal Generator, Schematic Diagram	5-3
5-2	Model 1108E Modular Microwave Signal Generator, Schematic Diagram	5-5
5-3	Model 1207E Modular Microwave Signal Source, Schematic Diagram	5-7
5-4	Model 1208E Modular Microwave Signal Source, Schematic Diagram	5-9
5-5	Pushbutton Board Assembly A3, Schematic Diagram	5-11
5-6	High Voltage Control Board Assembly A4, Schematic Diagram	5-13
5-7	High Voltage Box Assembly A5, Schematic Diagram	5-15
6-1	Part List Example	6-1

LIST OF TABLES

Table		Page
1-1	Equipment Supplied	1-3
1-2	Equipment Specifications	1-4
1-3	Transistors, Diodes, Integrated Circuits, and Klystron Complement	1-6
2-1	Operating Controls, Indicators, and Connectors	2-4
2-2	Modular Microwave Instrument Combinations	2-7
4-1	Test Equipment Required	4-2
4-2	Minimum Performance Standards	4-4
4-3	Troubleshooting Procedure	4-8
5-1	Voltage and Resistance Measurements, Models 1107E, 1108E, 1207E, and 1208E	5-17
6-1	Manufacturer's Code	6-2
6-2	Parts List	6-3

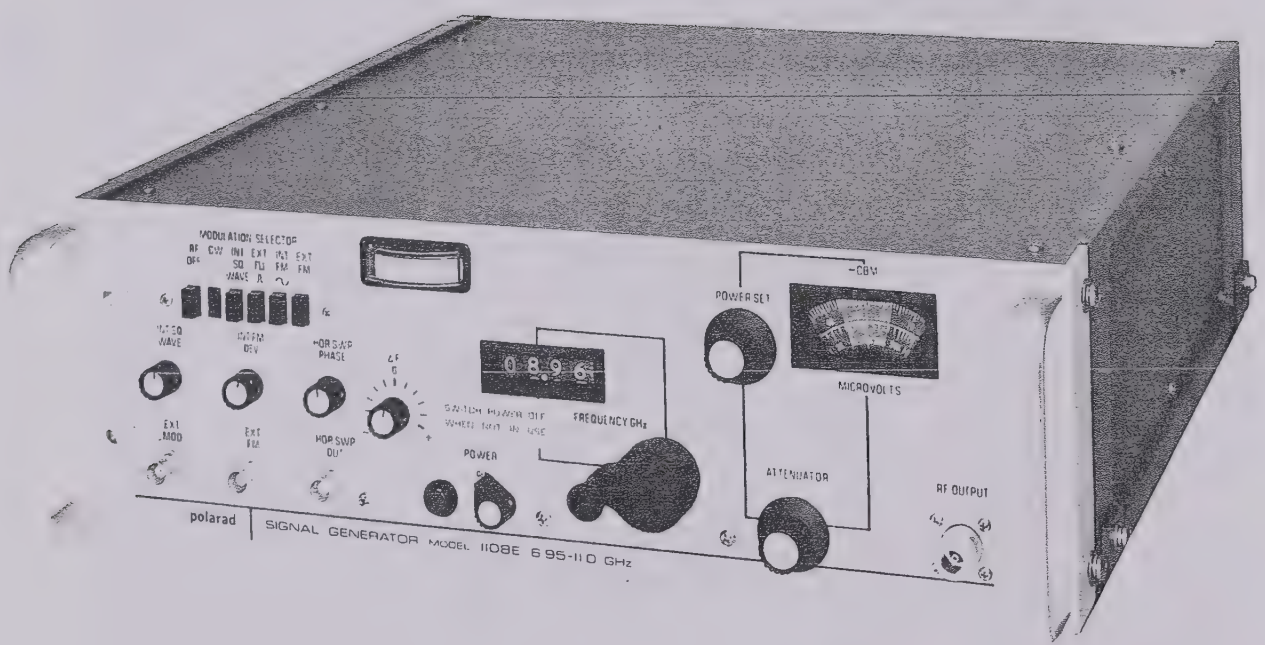


Figure 1-1. Modular Microwave Signal Generator Model 1108E

SECTION I

INTRODUCTION

1-1. SCOPE OF MANUAL.

1-2. This manual contains instructions for the use and maintenance of the Modular Microwave Signal Generators, Models 1107E and 1108E (figure 1-1), and Signal Sources, Models 1207E and 1208E manufactured by Polarad Electronics Inc., Lake Success, New York. The manual includes a general description of the instruments, operating instructions, theory of operation, maintenance data, and a parts list.

1-3. PURPOSE AND USE OF INSTRUMENTS.

1-4. SIGNAL GENERATORS, MODELS 1107E AND 1108E. The frequency range of Model 1107E is 3.70 to 8.40 GHz and the frequency range of Model 1108E is 6.95 to 11.0 GHz. The ratings for uncalibrated power output for Model 1107E are at least 10 mw from 3.7 to 7.6 GHz, and at least 5 mw from 7.6 to 8.4 GHz. The Model 1108E provides uncalibrated power outputs of at least 10 mw from 6.95 to 11.00 GHz. The range of the calibrated attenuator is typically +3 to −127 dBm with an absolute accuracy of ±2 dB. Typically more than rated power is available. However, when the ATTENUATOR control is adjusted for more than the rated output levels, it is possible to overcouple the pickup probe, causing minor frequency shifts and, with excessive overcoupling, reduction of power output.

1-5. Typical uses of the Signal Generators are testing broad- and narrow-band microwave systems and components such as amplifiers, antennas, attenuators, beacons, crystal mounts, hybrid junctions, preselectors, radars and receivers. These instruments can also be used to make specific measurements of bandwidth, attenuation, frequency dial calibration, image rejection, sensitivity, power gain, VSWR and other characteristics. They can also be used as a receiver local oscillator, modulated transmitter, or system microwave reference in checkout equipment.

1-6. SIGNAL SOURCES, MODELS 1207E AND 1208E. The models 1207E and 1208E Signal Sources, provide a maximum power output over their frequency ranges as shown in figure 1-2. The Signal Sources differ from the Models 1107E and 1108E Signal Generators in that their attenuators are not calibrated and their output impedances are very low. The frequency ranges of the Signal Sources are identical with those of the corresponding Models 1107E and 1108E Signal Generators.

1-7. Typical uses of the Signal Sources are in the investigation of antenna patterns and characteristics, measurement of attenuation, gain, insertion loss, Q, selectivity, frequency, and signal-to-noise ratio. They can also be used for alignment of communication and radar systems and components. When either Signal Source is used with the appropriate Frequency Doubler (Models 1509 and 1510, respectively), the combination provides all facilities of a signal generator at double the Signal Source frequency. See Table 2-2 for frequency coverage.

1-8. The Modular Microwave Signal Generators, Models 1107E and 1108E, and Signal Sources, Models 1207E and 1208E, incorporate phase lock provisions to increase their frequency stability when used with an external oscillator synchronizer.

1-9. The Modular Microwave Signal Generators, Models 1107E and 1108E and Signal Sources, Models 1207E and 1208E, incorporate provisions for external motor drive. The tuning shaft extends through the rear of the instruments for this purpose.

1-10. GENERAL DESCRIPTION.

1-11. The Modular Microwave Signal Generators, Models 1107E and 1108E, and Signal Sources, Models 1207E and 1208E, which hereafter will be referred to by model number, are identically-sized, self-contained, compact instruments suitable for bench or rack use. The instruments are line-powered and consist of a panel, a frame or chassis, and dust covers. The panel serves as a mounting for the controls, connectors, and power level monitoring meter (1107E and 1108E only). The handles at either end of

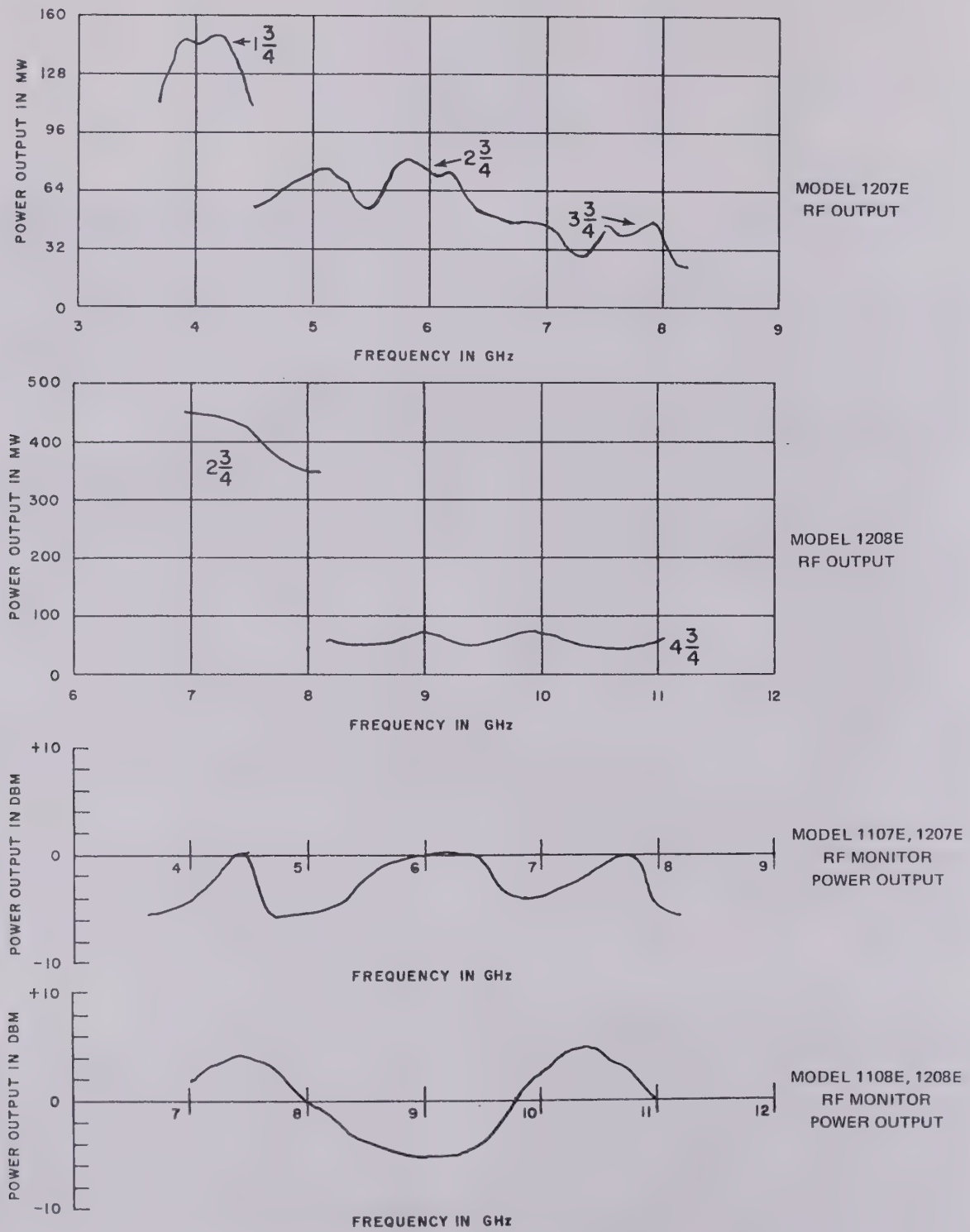


Figure 1-2. Typical RF Outputs and RF Monitor Power Outputs.

the panel are reversible for bench or rack use. The dust covers, which are side, top, and bottom panels, enclose and protect the internal components of the instrument.

1-12. EQUIPMENT SUPPLIED.

1-13. Table 1-1 lists the equipment supplied for the Models 1107E, 1108E, 1207E, and 1208E instruments.

1-14. EQUIPMENT SPECIFICATIONS.

1-15. Table 1-2 lists the equipment specifications for the Models 1107E, 1108E, 1207E, and 1208E instruments.

1-16. TRANSISTORS, DIODES, INTEGRATED CIRCUITS AND KLYSTRON COMPLEMENT

1-17. Table 1-3 lists the transistors, diodes, integrated circuits, and klystron complement of Models 1107E, 1108E, 1207E, and 1208E.

1-18. ACCESSORIES FOR POLARAD SIGNAL GENERATORS AND SOURCES.

1-19. The **Polarad Model 1020A Modulator** is a solid state function generator which provides adjustable, well-defined, precise pulses, square wave, and sawtooth waveforms for pulse, FM, and square wave modulation. It is a valuable accessory for the 0.80-21 GHz Series 1100 Signal Generators and Series 1200 Signal Sources. It can also be used with many other instruments. The repetition rates of all output waveforms are adjustable from 10 to 10,000 Hz. Pulse widths are adjustable from 0.2 to 2000 microseconds. The linear sawtooth output is adjustable in amplitude to vary FM deviation. The 1020A Modulator can be synchronized internally, or externally by positive pulses, negative pulses, or sine waves. Sharp 25 volt sync pulse outputs are also generated. Sync outputs are available undelayed and delayed, from two output terminals. The delay is adjustable from 0.3 to 2000 microseconds. The compact Polarad Model 1020A Modulator is provided in a 1-3/4" high modular cabinet which permits convenient rack mounting or stacking with other modular units of this series of Polarad instruments. Four side mounting brackets are supplied for rigid attachment to any companion Polarad instruments. When the top cover is removed, all parts are available for accessibility and ease of servicing. Dimensions: 1-3/4" H x 16-3/4" W x 16-3/8" D.

1-20. An external frequency stabilizer can be used to phase lock the output frequency of Polarad Microwave Signal Generators and Sources, as well as with other instruments. Short term stability is rated at 0.8 Hz per GHz per millisecond. Long term stability of 10 Hz per GHz per hour is achieved during continuous operation in typical laboratory environments. The crystal controlled reference oscillator is mounted within a proportional temperature compensating oven. Dimensions: 5-1/4" H x 16-3/4" W x 17" D.

1-21. **The Klystron Cap Extender, Part No. B160465,** separates the klystron cap from the oscillator cavity during frequency alignment. Klystron rotational alignment is simplified when the extender is used.

1-22. The **Generator Test Set MK-2** is used to check the initial parameters of the Generators/Sources. MK-2 is extremely useful for troubleshooting and aligning of the electronics of Generators/Sources.
Additional technical and ordering information available upon request from:

Polarad Electronics, Inc.
5 Delaware Drive
Lake Success, New York 11042

TABLE 1-1. EQUIPMENT SUPPLIED

Name	Polarad Model or Part No.	Name	Polarad Model or Part No.
Modular Microwave Signal Generator	1107E (1) 1108E (1)	Instruction Manual	
		Power Cable	B160833
Modular Microwave Signal Source	1207E (1) 1208E (1)	Spanner Wrench	AP15550
		Test Connector	C162119-5
RF Cable Assembly	B12551		

1. Either one.

TABLE 1-2. EQUIPMENT SPECIFICATIONS

Characteristic	Specification	
Frequency range	1107E/1207E: 3.70 to 8.40 GHz 1108E/1208E: 6.95 to 11.0 GHz	
Frequency accuracy	±0.5% (digital readout)	
Frequency stability	0.0008%/volt change in line, 0.005%/°C ambient	
ΔF control	Range of 1.5 MHz minimum	
Rated uncalibrated power output	1107E:	⩾ 10 mw from 3.7 to 7.6 GHz ⩾ 5 mw from 7.6 to 8.4 GHz
	1108E:	⩾ 10 mw from 6.95 to 11.0 GHz
	1207E:	⩾ 60 mw from 3.7 to 4.3 GHz ⩾ 25 mw from 4.3 to 5.0 GHz ⩾ 55 mw from 5.0 to 6.6 GHz ⩾ 25 mw from 6.6 to 8.4 GHz
	1208E:	⩾ 75 mw from 6.95 to 8.00 GHz ⩾ 30 mw from 8.00 to 11.0 GHz
Attenuator range	1107E/1108E:	+6 dBm (0.310 volts) to −130 dBm (0.1 microvolts)
Output power absolute accuracy	1107E:	±2 dB from 3.7 to 7.6 GHz* ±2.5 dB from >7.6 to 8.2 GHz*
	1108E:	±2 dB from 6.95 to 11.0 GHz *
Output impedance	1107E/1108E:	50 ohms, nominal
Output VSWR	1107E/1108E:	2:1 maximum
Types of output available	CW, square wave, or fm, without external modulation	
Internal square wave:		
Rate	1000 ± 5% Hz, minimum	
On-off ratio	Infinite	
Synchronization	Internal	

* When power monitor meter is set to CAL

TABLE 1-2. EQUIPMENT SPECIFICATIONS (Cont'd)

Characteristic	Specification
Internal fm:	
Rate	Power line frequency
Sweep Width	Continuously adjustable from 0 to 10 MHz, typical
Horizontal sweep output for scope time base	2 volts p-p min., power line frequency
Phase control range	Adjustable to 90°, minimum
External pulse modulation:	(Polarad Model 1020A recommended)
Level	Positive polarity, 15 to 50 volts peak
Rate	Single pulse to 100 kHz
Width of output pulses	0.2 to 2,500 microseconds
Rise time of output pulses	1107E/1207E: $\leqslant$ 0.15 microseconds
	1108E/1208E: $\leqslant$ 0.10 microseconds
Decay time of output pulses	1107E/1207E: $\leqslant$ 0.15 microseconds
	1108E/1208E: $\leqslant$ 0.10 microseconds
External fm modulation:	
Type and rate	Any waveshape having frequency components between 10 Hz and 0.5 MHz
Sweep width	Adjustable from 0 to 10 MHz,typical
RF monitor output	>-10 dBm
Power requirements	115 or 230 volts ± 10%, 50-60 Hz, 140 watts (50 to 400 Hz range optional, F option)
Dimensions	5¼"(13.4 cm) H x 16¾"(42.5 cm) W x 18¼"(47.1 cm) D
Weight	44 pounds (20 kg)

TABLE 1-3. TRANSISTORS, DIODES, INTEGRATED CIRCUITS, AND KLYSTRON COMPLEMENT

Quantity	Description	Type No.	Quantity	Description	Type No.
2	BRIDGE RECTIFIER	MDA-970-1	1	TRANSISTOR	D40D7
1	BRIDGE RECTIFIER	MDA-920A-3	2	TRANSISTOR	IRF522
9	DIODE	CG3F	3	TRANSISTOR	MJE3055T
1	DIODE	SH30F	1	TRANSISTOR	2N3906
6	DIODE	1N456	1	TRANSISTOR	2N4402
1	DIODE	1N914	1	TRANSISTOR	2N5190
2	DIODE	1N4002	2	TRANSISTOR	2N5415
2	DIODE	1N4742A	1	INT. CIRCUIT	MC78M20CP
2	DIODE	1N4751A	1	INT. CIRCUIT	CD4013A
2	DIODE	1N4759A	1	INT. CIRCUIT	SN72555P
1	DIODE	1N4762A	1	INT. CIRCUIT	SN72723L
1	DIODE	1N5366B	1	INT. CIRCUIT	UA78-GUIC
1	DIODE	1N5382B	1	INT. CIRCUIT	40014P
			1	KLYSTRONS	A160011A* A160034** A160035***

*Used in Models 1107E and 1207E only.
**Used in Model 1108E only.
***Used in Model 1208E only.

SECTION II

OPERATION

2-1. GENERAL.

2-2. Models 1107E, 1108E, 1207E, and 1208E are shipped complete and ready to operate; no special or permanent installation procedures are required. The instrument should be unpacked upon receipt, observing the usual precautions customary when unpacking an electronic instrument.

2-3. INSTALLATION.

2-4. After unpacking the instrument, plan its installation. If it will be used on a bench or cart, the required space is shown in figure 2-1. If it will be mounted in a rack, the handles at either end of the panel should be reversed as shown in figure 2-1 for rack mounting. The instrument requires 115 or 230 volts, single phase, 50-60 Hz ac power.

Note

Models 1107E, 1108E, 1207E, and 1208E are shipped ready for 115-volt operation. If the instrument will be operated from a 230-volt source, set the 115/230 volt switch in the rear to the 230-volt position and change fuse to 0.75 amp. The location of the switch is shown in figure 2-2.

2-5. Connect power line cord B160833 to ac input of the instrument and then into an ac power source.

2-6. OPERATING PROCEDURES.

2-7. The operating procedures for Models 1107E, 1108E, 1207E, and 1208E are described in paragraphs 2-8 through 2-14.

2-8. OPERATING CONTROLS, INDICATORS, AND CONNECTORS. The operating controls, indicators, and connectors of the instrument are shown in figure 2-2, and their functions are listed in table 2-1.

2-9. CONNECTION AND PRELIMINARY OPERATION. To operate Models 1107E, 1108E, 1207E, and 1208E, proceed as follows:

a. Connect instrument to device under test and external modulation source, if required, as shown in figure 2-3.

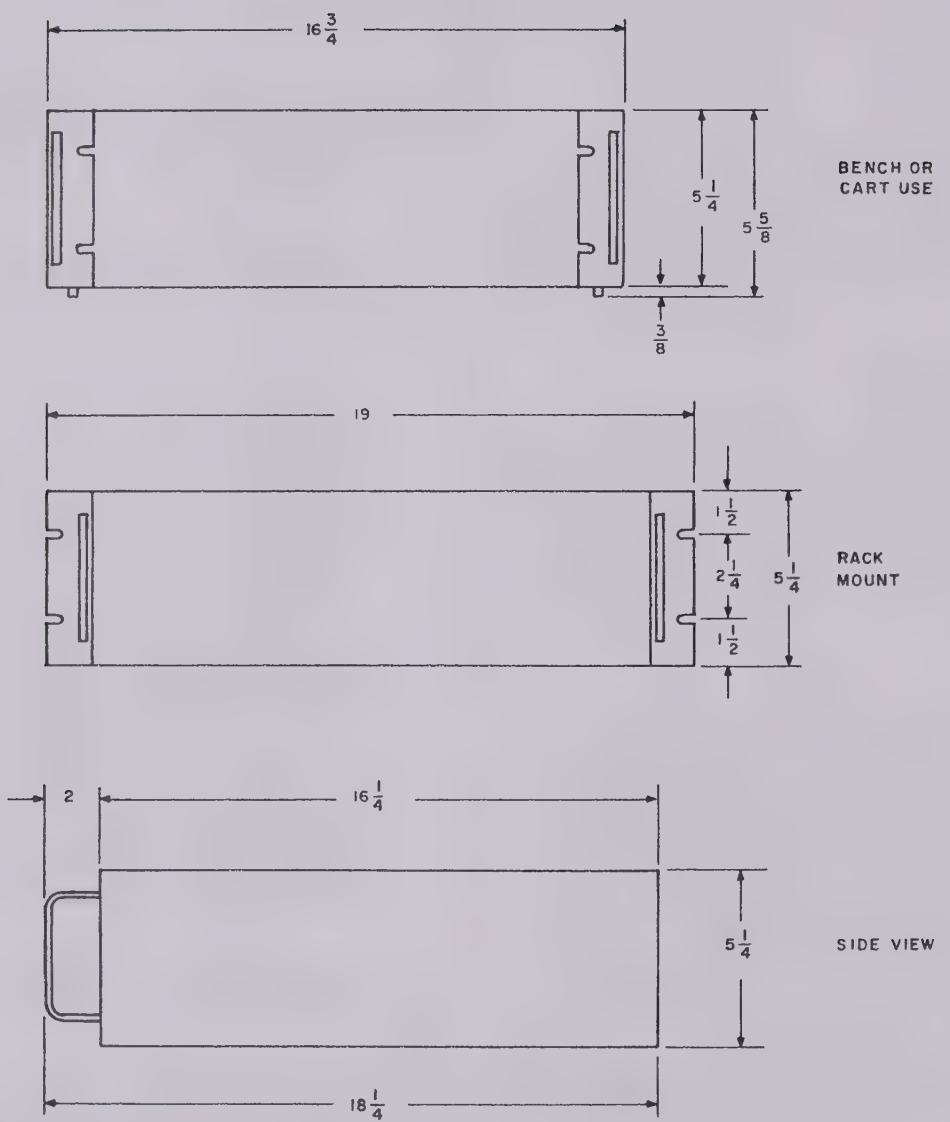
CAUTION

During the initial operation of the unit, the ΔF control should be set at "0." It is used for fine frequency adjustment up to 1.5 MHz. Caution should be exercised, however, when offsetting the ΔF control. At some frequencies, its range is so great that the oscillator mode may be shifted by excessive ΔF rotation. This effect may result in large frequency shifts that may appear to be a loss of signal or jump in frequency in equipment under test. For normal operation, return the ΔF control to "0" and limit the ΔF rotation as required. The lower frequency range of Models 1107E and 1207E between 3.7 to 4.0 GHz, is particularly sensitive to excessive ΔF rotation.

b. Set POWER switch to ON and allow the instrument to warm up for 15 minutes.

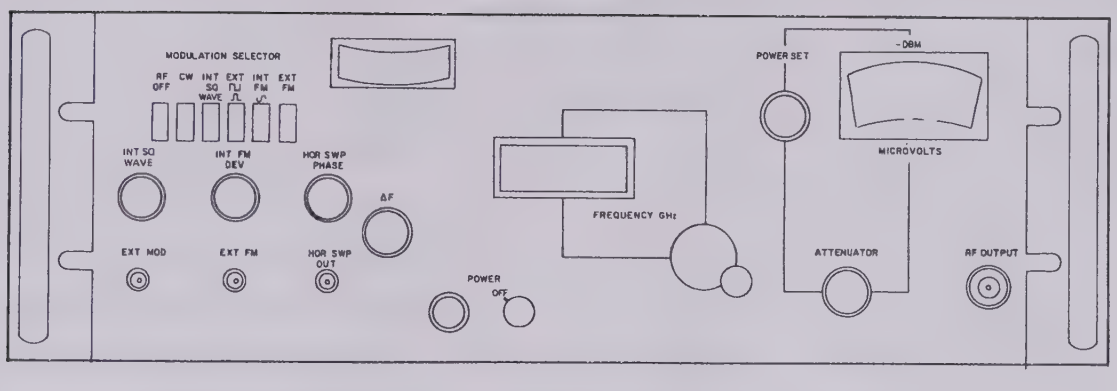
c. Tune the frequency control for a readout of the desired frequency on the FREQUENCY GHz dial.

d. On Models 1107E and 1108E only, set the MODULATION SELECTOR switch to CW position and adjust the POWER SET control for a power monitor meter indication of CAL.

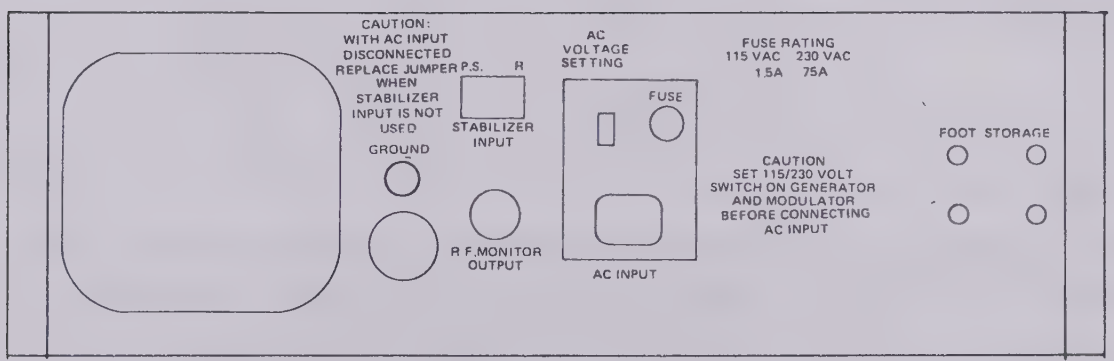


Note: All dimensions are in inches.

Figure 2-1. Models 1107E, 1108E, 1207E, and 1208E. Outline Installation Drawings



FRONT PANEL



REAR PANEL

Figure 2-2. Operating Controls, Indicators, and Connectors

TABLE 2-1. OPERATING CONTROLS, INDICATORS, AND CONNECTORS

Controls, Indicators, and Connectors	Function
POWER switch	Controls application of ac power
Power indicator lamp	Lights when power is applied to instrument
MODULATION SELECTOR pushbutton switch	Selects type of modulation as follows: RF OFF . . . . . Disables rf output; standby position CW . . . . . No modulation present INT SQ WAVE . . . . . Internal square wave modulation EXT ⊓⊔⊓ . . . . . External square wave or pulse modulation INT FM ~ . . . . . Internal FM line frequency modulation EXT FM . . . . . External FM modulation
INT SQ WAVE control	Adjusts square wave frequency over the range of 950 to 1050 Hz minimum
INT FM DEV control	Adjusts amplitude of internal fm driving signal
HOR SWP PHASE control	Controls phase of horizontal sweep signal to oscilloscope
EXT MOD connector	Accepts external pulse or square wave modulation signal
EXT FM connector	Accepts external fm signal
HOR SWP OUT connector	Output for horizontal sweep signal to oscilloscope
FREQUENCY GHz dial	Displays digital frequency readout
Frequency control	Adjusts instrument frequency
ΔF control	Fine frequency control. May be used to maximize system power output, control pulse jitter, and center FM sweep
ATTENUATOR control	Adjusts power level of instrument
RF OUTPUT connector	Available RF power
POWER SET control**	Used to adjust oscillator power level for power monitor meter indication of CAL
Attenuator dial**	Displays readout in dBm and microvolts of attenuator output at the RF OUTPUT connector when power meter is set to CAL
Power monitor meter**	Used to set power level of instrument for attenuator calibration
RF MONITOR OUTPUT connector*	Used for automatic frequency stabilization or auxiliary RF OUTPUT
STABILIZER INPUT terminals*	Used for automatic frequency stabilization
AC INPUT connector*	Power cord input
115/230V selector switch*	Selected according to ac voltage of power source
FUSE*	Protects instrument from damage

*Located on rear panel.
**Model 1107E and 1108E only.

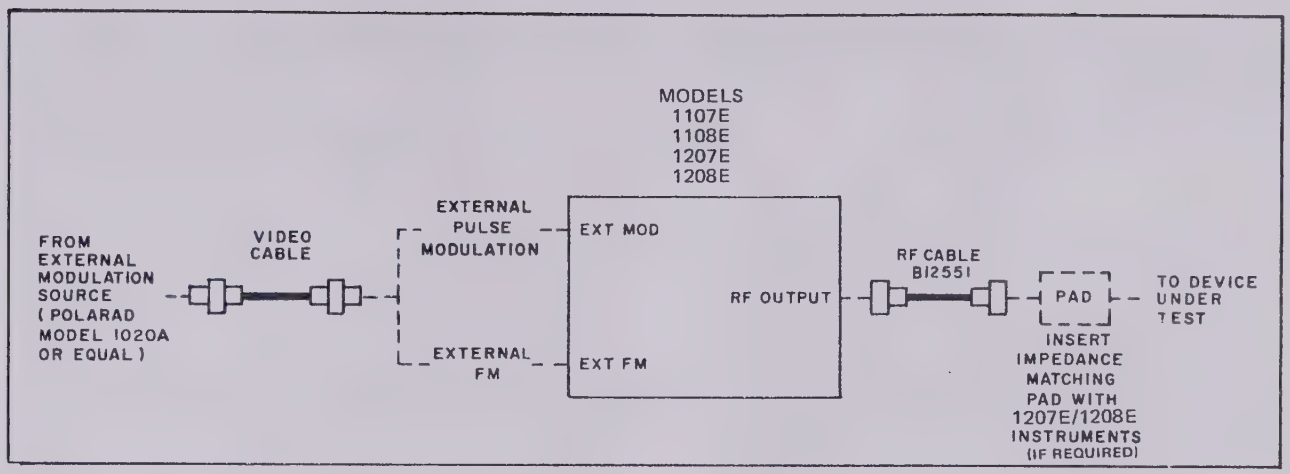


Figure 2-3. Models 1107E, 1108E, 1207E, and 1208E. Connections for Use

Note

The power monitor meter is graduated from −3 to +3, with the CAL marking midway between the extremes. If the POWER SET control is adjusted to obtain an indication other than CAL, the indication of the power monitor meter should be algebraically added to the reading of the attenuator dial. For example, if the power monitor meter reads −2 and the attenuator dial is set at −56 dbm, the power level at the RF OUTPUT connector would be −58 dbm.

e. On Models 1107E and 1108E only, adjust the ATTENUATOR control for the desired power output level at the RF OUTPUT connector. If required, correct the reading of the attenuator dial for power monitor meter readings other than CAL, as described in the preceding note.

Note

Use of the 6 db range of the power monitor meter provides an additional 3 db at each end of the power output range, giving an overall range from +6 dbm to −130 dbm.

f. On Models 1207E and 1208E, set the MODULATION SELECTOR switch to CW and adjust the ATTENUATOR control for the desired power output level at the RF OUTPUT connector. There is no attenuator dial on these models.

g. To operate Models 1107E and 1108E at another frequency, perform steps c, d, and e.

h. To operate Models 1207E and 1208E at another frequency, perform steps c and f.

Note

The ΔF control provides a frequency vernier with a minimum range of 1.5 MHz. Always reset to "0" when not used.

i. To place the set on stand-by; set the MODULATION SELECTOR switch at RF OFF.

2-10. CW OPERATION (1107E, 1108E, 1207E, 1208E). For CW operation proceed as follows:

a. Set the FREQUENCY GHz control to the desired frequency.

b. Depress the CW button on the MODULATION SELECTOR switch. In this mode, the INT SQ WAVE and INT FM DEV controls have no effect.

CAUTION

It is possible to make Signal Generators/ Sources inoperative by driving the attenuator probe too far into the oscillator cavity of the Signal Generator/Source. If this occurs, back off the attenuator by turning the ATTENUATOR control counter clockwise for Models 1107E and 1108E and clockwise for Models 1207E and 1208E. Set the MODULATION SELECTOR switch to RF OFF and repeat steps a and b of paragraph 2-10.

c. Set the ΔF control to "0."

d. Adjust the POWER SET control for a reading of CAL on the power meter.

e. Connect RF OUTPUT to unit under test.

f. Adjust the ATTENUATOR control for the desired output on the attenuator dial.

2-11. INTERNAL SQUARE WAVE MODULATION OPERATION (1107E, 1207E, 1108E, 1208E). For internal square wave modulation, perform steps a through f of paragraph 2-10.

Depress the INT SQ WAVE button on the MODULATION SELECTOR switch and adjust the INT SQ WAVE control for the desired square wave frequency.

2-12. INTERNAL FM OPERATION (1107E, 1108E, 1207E, 1208E). For internal fm operation, perform steps a through f of paragraph 2-10.

a. Depress the INT FM ~ button on the MODULATION SELECTOR switch.

b. Adjust the INT FM DEV control to obtain the desired sweep width.

Note

To obtain maximum FM deviation, it may be necessary to vary the ΔF control.

c. To observe frequency reponse of a component or system under test proceed as follows:

(1) Feed the RF OUTPUT signal through a frequency meter to the unit under test.

(2) Feed the detected output to the vertical input of an oscilloscope.

(3) The HOR SWP OUT is fed to the horizontal amplifier input of the oscilloscope.

(4) Set the vertical and horizontal gain of the oscilloscope for full scale deflection.

(5) Adjust the INT FM DEV control so that the FM deviation is sufficient to observe the frequency response.

(6) Adjust the HOR SWP PHASE control so that the forward and reverse sweeps are overlapped.

(7) Adjust the frequency meter to measure the frequency response by observing the pip from one end of the response to the other.

2-13. EXTERNAL FM OPERATION (MODELS 1107E, 1108E, 1207E, 1208E). For external fm operation, perform steps a thorugh f of paragraph 2-10.

a. Connect the modulation source to the EXT FM connector.

Note

Polarad Models 1020A and 1020-T Modulators are recommended for external pulse, FM, and square wave modulation.

b. Depress the EXT FM button on the MODULATION SELECTOR switch.

2-14. EXTERNAL PULSE/SQUARE WAVE OPERATION. For external pulse/square wave operation, perform steps a through f of paragraph 2-10 and proceed as follows:

a. Connect the modulation source to the EXT MOD connector.

b. Depress the EXT ⊓⊔ ⊓button of the MODULATION SELECTOR switch.

TABLE 2-2. MODULAR MICROWAVE INSTRUMENT COMBINATIONS

Signal Source	Signal Generator	Frequency Doubler	Modulator	Capabilities
–	1107E	*	1020A	1107E range with full modulation capabilities (Model 1607E)
–	1108E	*	1020A	1108E range with full modulation capabilities (Model 1608E)
1207E	–	1509	–	10.0-15.5 GHz range (Model 1709E)
1207E	–	1509	1020A	10.0-15.5 GHz range with full modulation capabilities (Model 1809E)
1208E	–	1510	–	15.0-21.0 GHz range (Model 1710E)
1208E	–	1510	1020A	15.0-21.0 GHz range with full modulation capabilities (Model 1810E)

*Models 1107E and 1108E can be used with Frequency Doublers Models 1509 and 1510 respectively. The power output will be somewhat less than provided by the Signal Sources Models 1207E and 1208E with the Doublers. Contact Polarad for additional information.

Note

At some frequency settings, it is advisable for most stable pulse modulation to adjust the ΔF control. A detector and an external oscilloscope can be used to display the detected output pulse.

2-15. AUTOMATIC FREQUENCY STABILIZATION. Models 1107E, 1108E, 1207E, and 1208E include provisions for automatic frequency stabilization to better than 10 Hz, with the degree of stabilization being dependent on the gain and stability of the external control system used. The input of the phase- or frequency-control system used is connected to RF MONITOR connector at the rear of the instrument and the output of the control system is connected to the STABILIZER INPUT terminals, also at the rear of the instrument.

2-16. OPERATION WITH OTHER MODULAR MICROWAVE INSTRUMENTS. In addition to the individual use of the Signal Generators and Sources, they can be grouped with other instruments in the Modular Microwave series to extend their capabilities. Table 2-2 lists some of the possible combinations and their capabilities. Models 1020A, 1207E, and 1509 can be stacked to form Model 1809E with frequency ranges of 3.7 to 8.4 GHz and 10.0 to 15.5 GHz and full modulation capability.

2-17. PACKAGING INSTRUCTIONS.

2-18. PACKAGING FOR SHORT TERM STORAGE. If the instrument is to be stored for a relatively short period, cover it with a suitable protective covering, such as a sheet of plastic or paper. Put the accessories and instruction manual in an envelope or bag and fasten it to the instrument to prevent loss. Store the instrument in a clean and dry area where it will not be subjected to extreme temperatures.

2-19. PACKAGING FOR LONG TERM STORAGE OR SHIPMENT. (See figure 2-4.) If the instrument is to be stored for a long time or shipped, proceed as follows:

a. Save the original wrappings and carton and repackage the instrument in them. The original packing material properly cushions the instrument for shipment.

b. If the original packing has not been saved, call Polarad Electronics Inc. for proper shipping instructions.

2-20. SHUT-DOWN PROCEDURE. To shut-down the Signal Generator turn the POWER switch to OFF and disconnect the power cable from its power source.

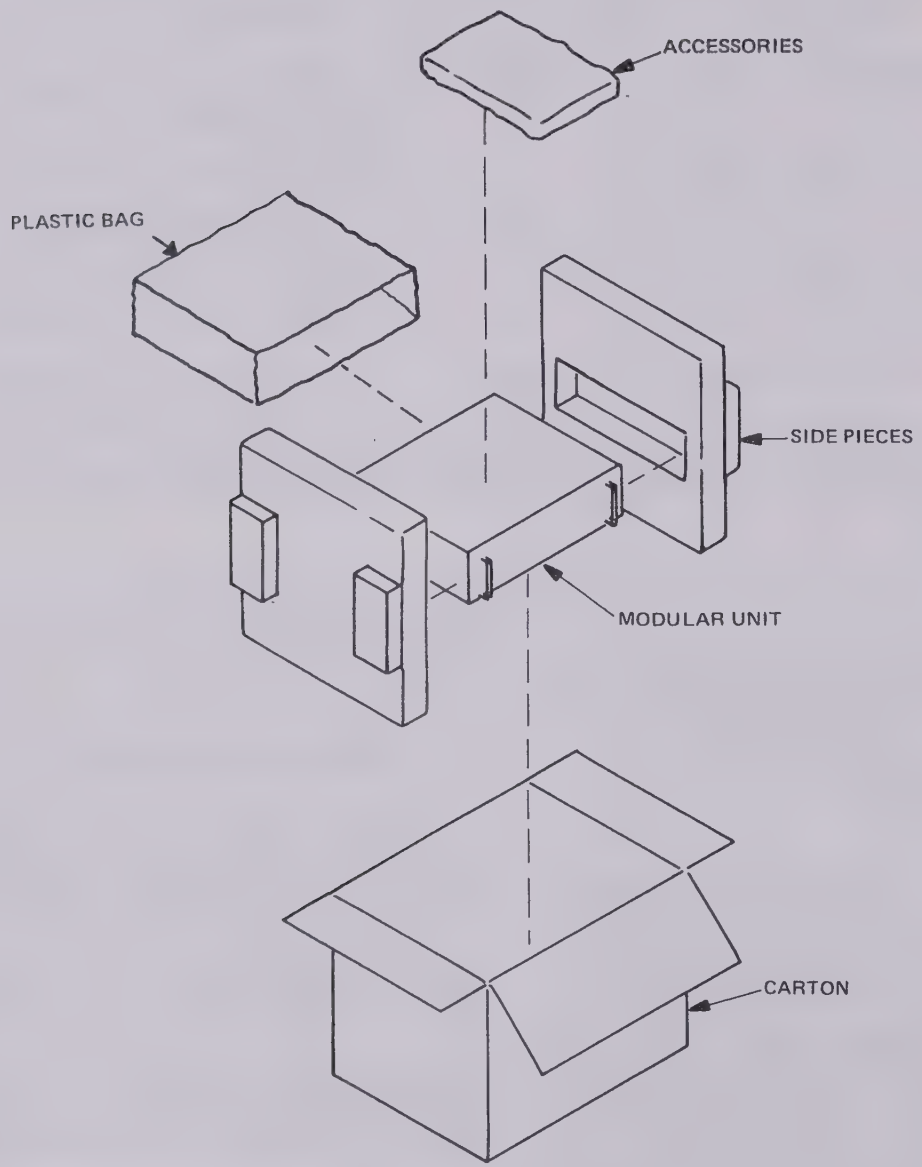


Figure 2-4. Packaging Diagram

SECTION III

THEORY OF OPERATION

3-1. GENERAL.

3-2. The Modular Microwave Signal Generators and Sources, Models 1107E, 1108E, 1207E, and 1208E, are signal-generating devices that employ klystron oscillators with external cavities to generate rf energy. The signal generator models, 1107E and 1108E, have calibrated attenuators and 50-ohm output impedance; the signal source models, 1207E and 1208E, have uncalibrated attenuators and a low reactive output impedance. The signal generators and sources have identical principles of operation, differing only in attenuator calibration and power monitoring, output impedance, and output power level. The 1107E and 1108E have a maximum calibrated power output of +3 dbm (0.310 volts), and the 1207E and 1208E have a power output of at least 25 milliwatts. The frequency ranges of the generators and sources are listed below.

Models	Range, GHz
1107E, 1207E	3.7 to 8.4
1108E, 1208E	6.95 to 11.0

3-3. The ensuing theory of operation coverage will be for all four models (1107E, 1108E, 1207E, 1208E), except where specific model reference is made.

3-4. BLOCK DIAGRAM ANALYSIS.

3-5. The Signal Generators and Sources, shown in block diagram form in figure 3-1, consist of eight principal circuit elements: a klystron oscillator, its repeller tracking system, a beam power supply, a repeller power supply, a 40V power supply for modulation circuits, a Schmitt trigger, a square wave generator and an amplifier circuit. The klystron oscillator employs a reflex klystron tube that is mounted into an external coaxial cavity, which is tuned to resonance by a non-contacting short tuning plunger driven by the FREQUENCY GHz control. The frequency drive system also operates the digital readout frequency dial and the tracking system, which selects the proper repeller mode and adjusts the repeller voltage for the frequency selected. The power supplies are completely solid-state using monolithic linear integrated circuits as precision voltage regulators. The Schmitt trigger followed by the amplifier delivers the square wave and pulses to the klystron oscillator. The square wave generator is a D-type Flip Flop(A3A1U4) whose variable frequency is controlled by the timer A3A1U3 from 950 to 1050 Hz, minimum.

3-6. Models 1107E and 1108E incorporate a power monitoring circuit that enables the attenuator to be calibrated directly in dBm and microvolts. The power set drive system moves the power probe and the hairline of the attenuator dial. The power monitor probe couples rf power from the klystron cavity to the crystal detector and power monitor meter. When the POWER SET control is adjusted for a power monitor indication of CAL, the power monitor probe is coupled to approximately 1 milliwatt power level. The ATTENUATOR control operates the attenuator probe and the dBm-microvolts dial to provide a calibrated rf output.

3-7. Models 1207E and 1208E incorporate an uncalibrated output attenuator. The attenuator control operates the attenuator probe, which couples rf power from the klystron cavity to the rf output connector.

3-8. The Signal Generators and Sources incorporate a provision for automatic frequency stabilization. A sample of power in the klystron oscillator is fed to an external control system and the output of the external control system is fed to the klystron repeller as a correction voltage which is superimposed on the repeller voltage.

3-9. DETAILED THEORY OF OPERATION (See Figures 3-1, 5-1 thru 5-7)

3-10. KLYSTRON OSCILLATOR. A klystron oscilator, VI provides the rf power output. It is velocity-modulated, operating in an external resonant coaxial transmission line and consists of two conductors, one inside the other.

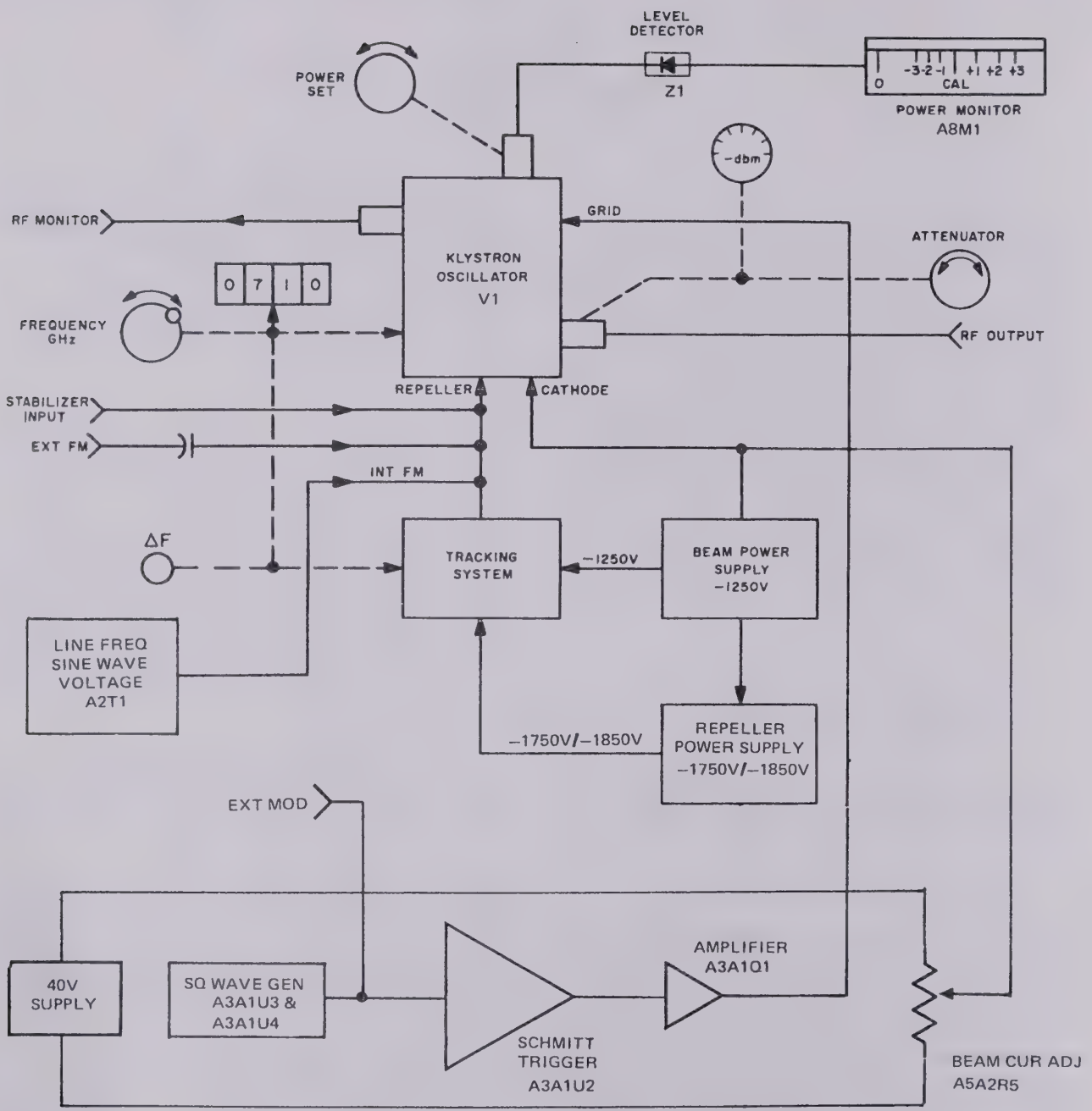


Figure 3-1. Modular Microwave Signal Generators/Sources (Models 1107E, 1108E, 1207E, and 1208E) Block Diagram

The klystron is mounted at one end of the cavity with the outer cylinder making contact with the first grid and the inner conductor making contact with the second resonator grid. The resonant circuit is completed at the other end of the cavity by a moveable non-conducting shorting plunger. The position of this plunger determines the resonant frequency of the cavity.

3-11. The frequency of oscillation of the klystron oscillator is determined by the resonant frequency of the cavity and the magnitude of the repeller voltage. For a given setting of the cavity, there is an optimum repeller voltage that will cause the bunched electrons to return to the resonator grids at the proper time. The repeller voltage, therefore, cannot remain the same over the frequency range of the oscillator. In order to produce oscillation over the frequency range of the oscillator, a tracking arrangement is used to vary the dc voltage on the repeller so that it is maintained at the optimum value for a given plunger setting. The required voltage ranges as a function of frequency, are shown in Figures 4-6 and 4-7.

3-12. MODE SWITCHING. At a certain frequency value (4.40 and 7.52 GHz for Models 1107E and 1207E, 8.15 GHz for Models 1108E and 1208E, approximately) the repeller voltage becomes excessively high and it is more practical to change the repeller voltage to a new range. This can be done without changing the frequency of oscillation at a given cavity setting by lowering the repeller voltage so that the tube operates in a higher mode. In the higher mode the bunched electrons require a longer time in cycles to be returned to the resonator grids. Models 1107E and 1207E operate in the 1¾, 2¾, and 3¾ modes, Models 1108E and 1208E operate in the 2¾ and 4¾ modes. The switching arrangement is described in paragraph 3-15.

3-13. The oscillator cavity is coupled through two probes; the attenuator probe with a variable amount of insertion that determines the rf power level delivered to the RF OUTPUT connector, and the fixed rf monitor probe that supplies the power sample for automatic frequency stabilization.

3-14. Models 1107E and 1108E incorporate a third power monitor probe, with a variable amount of insertion, that supplies power to the monitoring circuit for calibrating the output attenuator.

3-15. REPELLER VOLTAGE TRACKING SYSTEM. The dc voltage applied to the repeller is controlled by tracking potentiometer A7R1. The movement of the arm of A7R1 is mechanically ganged with the movement of the tuning plunger in the klystron cavity so that the repeller voltage is maintained at the optimum value for the maximum amplitude of oscillation. Repeller mode switch A7S1 (and A7S2 in Models 1107E/1207E) is operated by a cam driven by the tuning drive and changes the voltage applied to A7R1 so that a different mode can be used. The values of the resistors in the tracking circuit are calculated for the proper frequency-vs-voltage characteristic. Adjustment potentiometers are provided in the tracking circuit to compensate for variation in klystron repeller voltage characteristics. The maximum voltage across tracking potentiometer A7R1 is 500/600 v. since it is connected from the –1250 volt beam supply to the –1750/–1850 volt repeller supply. The cathode of klystron V1 is connected to the –1250 volt beam supply and therfore the repeller voltage can vary from 0 to –500/–600 volts.

Note

The ΔF control A3A2R28 provides a small variation in the repeller voltage, which produces a vernier frequency variation of at least 1.5 MHz.

3-16. PROTECTIVE DIODE. Protective diode A3A1CR4 is connected between the cathode and repeller of klystron V1 to prevent the repeller from becoming more positive than the cathode which would damage the klystron.

3-17. FREQUENCY CONTROL KNOB. The frequency control knob rotates the shaft which drives the digital readout, the cam that positions the tuning plunger, and the tracking potentiometer, each through the appropriate gearing. The shaft extends through the tuning mechanism casting to the rear of the instrument where it can be attached to an external motor drive, if required.

3-18. CALIBRATED ATTENUATION OPERATION. Power from the klystron cavity is coupled through two symmetrical pipes into two matched waveguide-beyond-cutoff attenuators. The POWER SET (Models 1107E and 1108E only) control positions the power set probe in its pipe. The power set probe couples rf power from the klystron cavity to the crystal detector and the power monitor meter and also moves the hairline of the attenuator dial. When the POWER SET (Models 1107E and 1108E) control is adjusted for a power monitor meter indication of CAL, the power set probe is coupled to

approximately 1 milliwatt power level. Should the energy level within the cavity change when the cavity is tuned to a different frequency, the power set probe must be reset to obtain the 1 milliwatt level of power absorption which will bring the power monitor meter back to its reference CAL position. At the same time, the hairline is repositioned to a new 0 dBm reference.

3-19. When the POWER SET (Models 1107E and 1108E) adjustment is set for CAL, the attenuator probe is adjusted for 0 dBm output at the same time that the attenuator dial is adjusted for 0 dBm under the hairline. In this way, as frequency is varied, and the power monitor meter is set for CAL by placing the attenuator dial at 0 dBm under the hairline, the output will be 0 dBm within the specification accuracy.

3-20. In order to obtain other levels of power, the ATTENUATOR control is adjusted so that the desired level is under the hairline of the attenuator dial. This adjustment varies the position of the attenuator probe in its waveguide-beyond-cutoff pipe. The rate of attenuation within the pipe follows a rigid physical law and is extremely accurate, thus the rate of attenuation is transcribed into the dial.

3-21. SCHMITT TRIGGER AND AMPLIFIER. The Schmitt trigger A3A1U2 is a gate with fast rise and decay times. The positive voltage to A3A1U2 is held at +12 volts and the negative supply at ground using dropping resistor A3A1R13 and zener diode A3A1CR1. The ground is referenced at −1270V. Diodes A3A1CR2 and A3A1CR3 act as protective diodes for A3A1U2 and A3A1C15 is a speed up capacitor to handle fast pulses. The input to the gate (pin 1) is held at +12V in the CW, INT FM and EXT FM positions and at ground (−1270 volts) in the RF OFF, INT SQ WAVE and EXT⊓⊔ ⊔⊓ positions via the MODULATION SELECTOR switch (see paragraph 3-24 for more details). The output of the gate (pin 2) is amplified by transistor A3A1Q1 to a suitable level so that the grid of the klystron is biased properly for different modes of operation. In the amplifier circuit A3A1CR5 is a protective diode for A3A1Q1, and A3A1C14 is a speed up capacitor. The amplifier itself acts as an inverter, and the gate A3A1U2 also acts as an inverter; therefore, the logic output of A3A1Q1 is the same as the input of the gate A3A1U2.

3-22. TIME DELAY CIRCUIT. There is a time delay of approximately 60 seconds when the set is turned on before the beam, repeller and control supply voltages are turned on. This delay is necessary in order that the klystron tube not be damaged. The time delay is accomplished by utilizing integrated circuit A4U1. Pin 3 of A4U1 is held high (approximately 12 volts) for a period determined by the RC time constant of A4R13 and A4C7. When A4C7 charges to a high enough level, the timer A4U1 changes its state at pin 3 from 12 volts to ground, which in turn, changes the output of voltage regulator A4U3 so that the oscillations start and all the supplies (−1250, −1750/−1850, and 40 V) turn on (see paragraph 3-32 for more details). Zener diode A4CR4 and resistor A4R14 are used to supply a bias voltage of 12 volts to integrated circuit A4U1.

3-23. SQUARE WAVE GENERATOR. Square waves, variable from 950–1050 Hz, are generated using A3A1U3 and A3A1U4. A3A1U4 is utilized as an oscillator whose frequency is determined by A3A1C17, A3A1R34, A3A1R36, and A3A1R37. The oscillator frequency is adjusted by varying A3A1R36. The oscillator output (pin 3) is fed to the D-type flip-flop A3A1U3 (pin 11). The output frequency of A3A1U3 is 1/2 that of the output of A3A1U4 as characterized by the flip-flop. The output of A3A1U3 (pin 13) is applied to the Schmitt trigger A3A1U2 through the MODULATION SELECTOR switch only in the INT SQ WAVE position. The bias supplies for A3A1U3 and A3A1U4 are tapped from the 40V supply in the same manner as for A3A1U2 (see paragraph 3-21). The bias supply is turned off when the INT SQ WAVE mode of operation is not used.

3-24. MODULATION SELECTION. The six-position MODULATION SELECTOR switch A3A1S1 selects the proper mode of operation for the various functions. The klystron grid is biased so that it is held positive (approximately 10V) with respect to the cathode in CW,INT FM~, and EXT FM positions and is held to cut-off(approximately −30 volts with respect to the cathode) in the RF OFF and EXT ⊓⊔ ⊔⊓ positions. In the INT SQ WAVE position it is switched between +10 and −30 volts. The grid voltage is determined by the adjustment of A5A2R5 which in turn sets the beam current (see paragraph 3-34c). The circuit operation in each position of the MODULATION SELECTOR switch is described in paragraphs 3-25 through 3-30.

3-25. RF OFF POSITION. In the RF OFF position, the voltage at the input to the Schmitt trigger gate is returned to ground through the MODULATION SELECTOR switch. The output of the amplifier A3A1Q1 is,therefore,at ground potential (−1280 ref gnd) and the grid is thus placed at a negative potential sufficient to drive the klystron into cut-off and thus inhibiting oscillation.

3-26. CW POSITION. In the CW position, the voltage at the input to the Schmitt trigger gate(pin 1 of A3A1U2) is

held at +12V (with respect to −1280V as referenced ground). The output of the amplifier is thus +40V and the grid is thus placed at a potential that permits the klystron to oscillate.

3-27. INT SQ WAVE POSITION. In the INT SQ WAVE position the intput to the Schmitt trigger is fed from the output of flip-flop A3A1U3.The square wave output of the flip-flop moves the Schmitt trigger gate up and down at the same rate. The grid driven by the amplifier, therefore, modulates the klystron oscillations, producing a square wave modulation of output. The rate itself, is controlled by the setting of A3A2R36 which changes the frequency of the basic oscillator A3A1U4.

3-28. EXT ⊓⊔ ⊔ POSITION. In the EXT ⊓⊔ ⊔ position, the input to the Schmitt trigger gate is placed at ground potential (−1280V) so that initially the klystron tube does not conduct. The input to the Schmitt trigger, however, is driven by positive going pulses from an external source applied at the EXT MOD connector J3. The klystron tube conducts only during that portion of the cycle when the pulse is on.

3-29. INT FM~ POSITION. In the INT FM~ position the Schmitt trigger is biased so that the output of the amplifier is at +40V; thus, the grid is at a potential so that oscillations in the klystron tube take place. The voltage on the repeller electrode of the tube is modulated by a sine wave voltage as derived from the line voltage through transformer A2T1. The FM deviation is determined by resistor A3A3R16 and the rate is fixed at the line frequency. In addition, a horizontal sweep output is available at connector J1 whose phase can be varied by HOR SWP PHASE control resistor A3A3R4. With the use of the HOR SWP OUT and PHASE controls, the rf output modulation can be viewed on an oscilloscope with the aid of an RF detector.

3-30. EXT FM POSITION. In the EXT FM position, the oscillations take place as described in the INT FM~ position. The repeller voltage is modulated by the external voltage applied at connector J2.

3-31. ΔF CONTROL. The ΔF control varies the repeller voltage over a relatively small range to provide a frequency vernier adjustment.

3-32. BEAM (−1250V), REPELLER (−1750/−1850V), AND THE +40V (−1280V)REF GROUND POWER SUPPLIES. The power supplies used for generation of beam, repeller and control circuits are not conventional. A block diagram of the processes by which high voltages are generated is shown in Figure 3-2. A low voltage power supply (approximately 31V) is derived from the line voltage using a conventional, step-down transformer A2T1, bridge rectifier, and filter networks for low ripple. It supplies the main current for subsequent conversion to a high voltage ac generator. The dc voltage is converted to a low voltage, high frequency, ac power source (20 KHz, typical) by oscillator A5Q1 and A5Q2. The low ac voltage is stepped up to suitable ac voltages by transformer A5T2.

3-32A. LOW VOLTAGE DC POWER SUPPLY. The main ac line voltage is stepped down to approximately 31 vac and rectified using bridge rectifier A4BR1. The rectified voltage is filtered and the ripple is kept low using Darlington capacitor multiplier A4Q4 and A4Q5. Capacitor A4C1 provides the fundamental filtering. The effective capacitance of A4C2 is increased by the current gains of A4Q4 and A4Q5.

3-32B. LOW VOLTAGE HIGH FREQUENCY AC VOLTAGE GENERATOR. The dc voltage, as generated in paragraph 3-32A, is subsequently converted into low ac voltage at a high frequency. A5A2U2 consists of an oscillator divider and gating which produces two non-overlapping pulses to drive the gates of A5Q1 and A5Q2. A5Q1 and A5Q2 amplify the pulses and drive the primary of A5T2. Power for the generator passes through current limiter A4Q1 from the +31V line. The voltage of the pulses driving A5Q1 and A5Q2 is controlled by A5A2Q3 and its associated circuitry which converts the collector current of A4Q3 into a voltage which is applied to the output drivers of A5A2U2. The collector voltage of A4Q2 is set initially (before A5Q1 and A5Q2 oscillate or the time delay is over) by Bias Adj resistor A4R4. Resistor A4R4 is in the base-emitter circuit of A4Q2; hence, it sets the voltage for the collector of A4Q2 or emitter of A4Q3. Initially the emitter of A4Q3 is set at approximately 11V. (The emitter to base voltage of A4Q3 is thus <0.7V.) The base voltage of A4Q3 is determined by the output voltage of A4U3 which is a monolythic integrated circuit. The voltage between the noninverting (pin 3) and inverting (pin 2) inputs of A4U3 is amplified internally by A4U3 and appears at pin 6, which in turn is connected to the base of A4Q3 through A4R9. Pin 10 of A4U3 is biased with resistors A4R16 and A4R17 such that the regulator is turned off initially. The junction of A4R16 and A4R17 is approximately 0.8V initially. When the delay time is over, this junction voltage changes to 0V and the regulator starts to regulate. The output at pin 6, which is determined by the voltage differences at pins 2 and 3, such that A4Q3 conducts and in turn A5Q1 and A5Q2 start to operate. The amplitude of the output is adjusted by A4R21. When A4R21 is adjusted, the base volt-

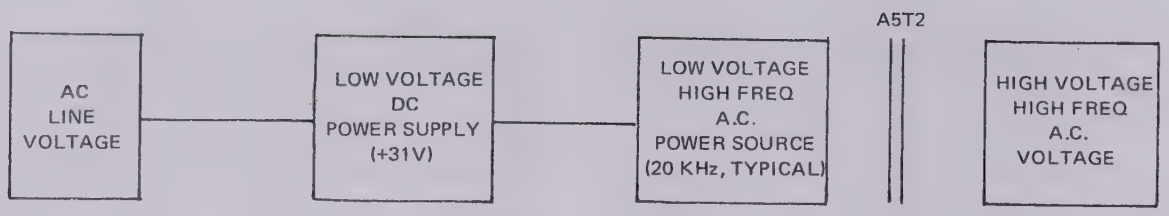


Figure 3-2. High Voltage Generation, Block Diagram

age of A4Q3 varies and this in turn varies the gate pulse voltage of A5Q1 and A5Q2 and hence the amplitude of the output. Voltage reference for pin 2 is derived from the fixed voltage regulator A4U2. Constant voltage is maintained at pin 6 and hence that of the oscillations amplitude by A4U3 which senses any variation of the difference in voltages between pins 2 and 3. Pin 2 is fixed by resistor network A4R19, A4R21, and A4R22 and at pin 3 voltage is derived by feedback network A4R18 and A5A1R7. If there is any variation at pin 3 due to load or line voltages, the regulator will correct all changes through its feedback loop and maintain a constant amplitude of oscillation. A4CR1 is added for the protection of A4Q3 and diodes A5A2CR1 to A5A2CR4 are added for the protection of A5Q1 and A5Q2. A5A2R11 adjusts the frequency of oscillation.

3-32C. HIGH VOLTAGE – HIGH FREQUENCY AC VOLTAGE. The output of the basic oscillator (low voltage, high frequency is stepped up through transformer A5T2 to suitable values.

3-32D. BEAM POWER SUPPLY. High voltage fast switching rectifier diodes A5A1CR9 to A5A1CR12 rectify the high voltage ac appearing across pins 8 and 10 of transformer A5T2. After suitable filtering, it is applied to the klystron cathode (–1250V).

3-32E. THE REPELLER VOLTAGE. AC voltage appearing across pins 4 and 6 of the transformer (Models 1107E and 1207E) or 4 and 7 (Models 1108E and 1208E) is rectified by diodes A5A2CR5 to A5A2CR8 and applied to the voltage regulator network A3A1CR8, A3A1CR9 to A3A1CR12, A3A1Q2 and A3A1Q3. A3A1CR8, A3A1CR9 to A3A1CR12 are zener diodes which establish a reference voltage for the regulator A3A1Q2 and A3A1Q3 are used in a Darlington arrangement to provide the necessary regulation. The ground repeller supply is referenced to the –1250V beam supply.

3-32F. THE +40V SUPPLY FOR CONTROL CIRCUITS. The bridge rectifier A5BR1 rectifies the ac voltage across pins 11 and 12 of transformer A5T2. This +40V is applied to the op-amp A5A2U1 whose output floats at –1250V. The output of the op-amp is connected to the inverting input (pin 2) of the op-amp and the non-inverting input is floating and can be varied from 0 to 32 volts (32 volts appearing across zener diode A5A2CR15) by resistor A5A2R5 and thus the entire +40V supply floats at –1250V

3-33. KLYSTRON FILAMENT SUPPLY. The klystron filament is supplied with regulated dc voltage to minimize drift and incidental amplitude and frequency modulation. The klystron filament supply consists of bridge rectifier A3A1BR1 and voltage regulator A3A1U1. It is referenced to the –1250V beam supply. The filament voltage is adjusted to 6.3V by potentiometer A3A1R1.

3-34. POWER SUPPLY ADJUSTMENTS. The power supplies are provided with three adjustments which are described below:

a. –1250 ADJ CONTROL. The –1250 ADJ control A4R21 sets the operating point for control amplifier A4U3 which maintains the beam power supply at its set value.

b. –1750/–1850 ADJ CONTROL. The –1750/–1850 ADJ control A3A1R2 sets the operating point for regulator A3A1Q2 and A3A1Q3 which maintains the repeller power supply at its set value.

c. BEAM CURRENT ADJ control. The BEAM CURRENT ADJ control A5A2R5, which has a range of approximately 32 volts, adjusts the beam current through the klystron. The beam current is measured by monitoring the voltage across A5A1R8 which appears between A4TP2 and A4TP4.

SECTION IV

MAINTENANCE

4-1. GENERAL.

4-2. This section contains maintenance and alignment procedures for the Modular Microwave Signal Generators and Sources, Models 1107E, 1108E, 1207E, and 1208E. Included in this section are a list of test equipment required, minimum performance standards for the instruments, a troubleshooting procedure, and the alignment procedures required for the instruments.

4-3. TEST EQUIPMENT REQUIRED.

4-4. Table 4-1 lists the test equipment required for the maintenance of Models 1107E, 1108E, 1207E, and 1208E. Test equipment of equivalent characteristics may be substituted for the items listed.

4-5. PRELIMINARY INSPECTION.

4-6. Perform a preliminary visual and manual inspection of the instrument before undertaking any maintenance procedure. Remove the top and bottom dust covers of the instrument to inspect its interior. Look for loose or damaged parts, dust, dirt, oil or grease, and corrosion. Correct such conditions before proceeding with maintenance.

WARNING

THE STABILIZER INPUT TERMINAL BOARD, ON THE REAR PANEL, HAS A REGULATED POTENTIAL OF 1750/1850 VOLTS DC ON ITS TERMINALS. SEVERE SHOCK OR DEATH MAY RESULT FROM ACCIDENTAL CONTACT WITH THESE TERMINALS. THE TERMINALS ARE COVERED TO PREVENT ACCIDENTAL CONTACT. THE COVER SHOULD NOT BE REMOVED UNLESS AN EXTERNAL LOCK BOX IS TO BE CONNECTED.

CAUTION

DO NOT DISTURB ANY ADJUSTMENTS ON COMPONENTS OF THE KLYSTRON OSCILLATOR CASTING. A COMPLETE REALIGNMENT MAY BE REQUIRED IF ANY ADJUSTMENTS ARE TOUCHED.

4-7. MINIMUM PERFORMANCE STANDARDS.

4-8. The minimum performance standards listed in table 4-2 will determine whether the instrument is operating within the specification limits listed in table 1-2.

4-9. TROUBLESHOOTING.

4-10. The troubleshooting procedure for the instrument is given in table 4-3. If the location of the trouble is indefinite or cannot be localized, start the troubleshooting procedure at the step that most closely resembles the trouble encountered.

WARNING

A REGULATED DC VOLTAGE OF 1750/1850 VOLTS WILL BE ENCOUNTERED DURING THE TROUBLESHOOTING TESTS. DO NOT CONNECT OR DISCONNECT TEST EQUIPMENT WHICH CONNECTS INTERNALLY WITH THE INSTRUMENT ENERGIZED.

4-11. DISASSEMBLY AND REASSEMBLY INSTRUCTIONS.

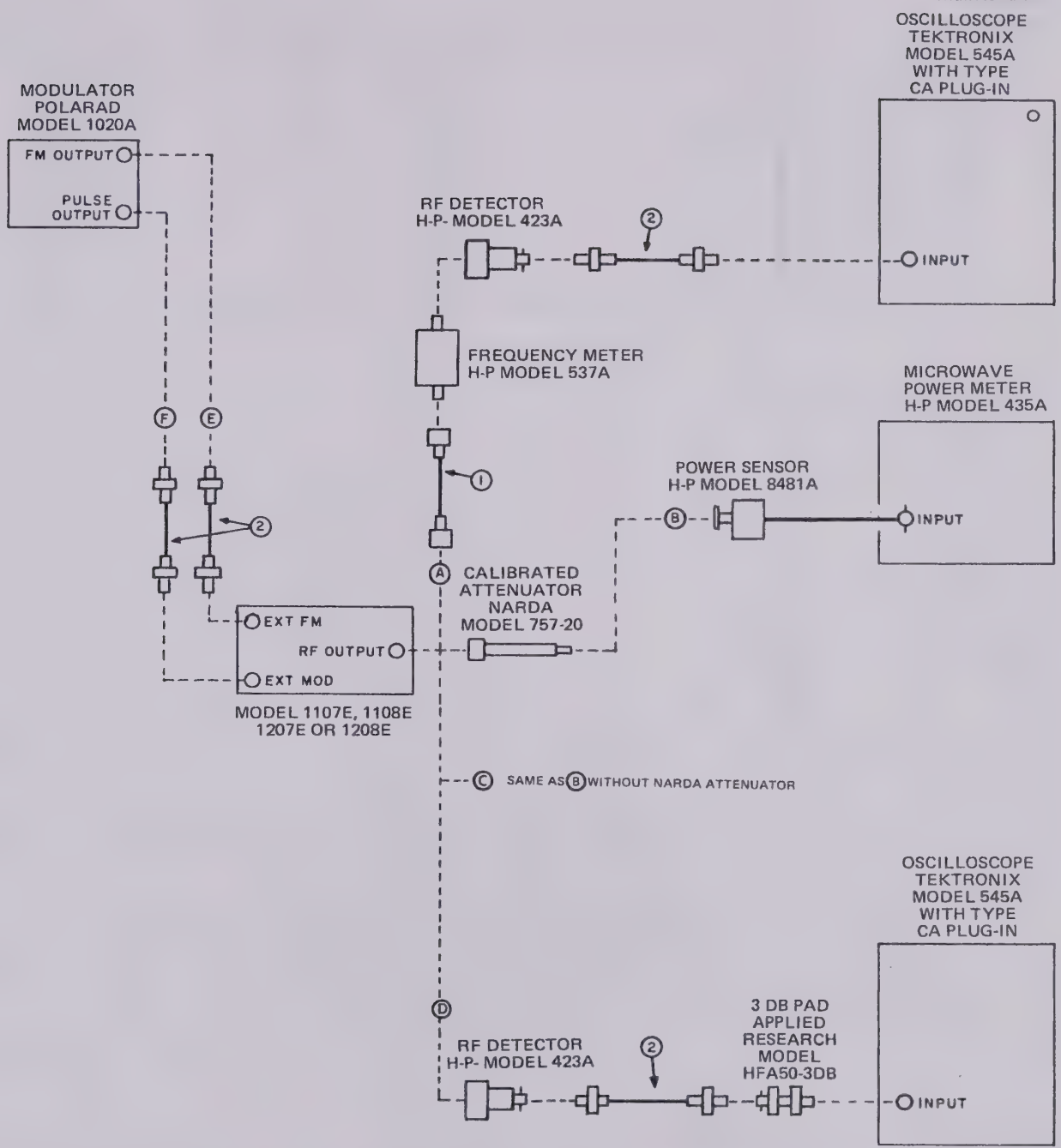
4-12. Disassembly and reassembly instructions for the instrument are given in paragraphs 4-13 through 4-17. Component locations are shown in figures 4-8 through 4-13.

Note

1. Do not disassemble the instrument beyond the point at which the necessary repair or replacement can be made. Perform the applicable minimum performance checks of table 4-2 after any replacement procedure given below.
2. If it is necessary to remove the RF ATTENUATOR probe or the POWER SET probe, replace the RF ATTENUATOR probe first and then the POWER SET probe for proper alignment (Models 1107E and 1108E only).

TABLE 4-1. TEST EQUIPMENT REQUIRED

Name	Manufacturer and Model No.	Use
DIFFERENTIAL VOLTMETER	Fluke Model 801	Voltage tests
FREQUENCY METER	Hewlett-Packard Model 537A	Frequency tests
MODULATOR	Polarad Model 1020A	External modulation tests
MULTIMETER, DIGITAL	Fluke Model 8000A	Voltage, current, and resistance tests
OSCILLOSCOPE	Tektronix Model 545A with Type CA plug-in	Frequency, square wave, and pulse tests
PAD, 3 db	Applied Research Model HFA50-3DB	Square wave and pulse tests
PAD, 20 db	Narda Model 757-20	Power output tests
POWER METER WITH SENSOR	Hewlett-Packard Model 435A and 8481A	Power output and attenuator tests
RF DETECTOR	Hewlett-Packard Model 423A	Klystron mode alignment, square wave and pulse tests
VOLTBOX	Fluke Model 605B	Voltage tests



(1) RF CABLE P/N B12551 SUPPLIED WITH MODELS 1107E, 1108E, 1207E, 1208E.

(2) VIDEO CABLE

(A) FREQUENCY ACCURACY

(B) POWER OUTPUT TESTS

(C) ATTENUATOR ACCURACY TESTS

(D) INTERNAL SQUARE WAVE AND FM TESTS

(E) EXTERNAL FM TESTS

(F) EXTERNAL PULSE TESTS

Figure 4-1. Minimum Performance Standards Test Setups

TABLE 4-2. MINIMUM PERFORMANCE STANDARDS

Step	Purpose	Procedure	Normal Indication	Abnormal Indication Ref.
1	Evaluate power operating conditions	Connect instrument under test to power source and set POWER switch to ON.	POWER indicator lights when power is applied. Delay circuit operates after approximately 60 seconds.	Check DS1, A1F1, A1S1, power cable, and setting of 115/230 volt switch A1S2. Check A4U1 and associated components.
2	Evaluate POWER SET operation (1107E and 1108E)	Adjust the instrument under test for CW operation at low end of frequency range. Refer to paragraph 2-10.Tune thru the frequency band,resetting the POWER SET control for CAL. 1107E: 3.7 to 8.4 GHz 1108E: 6.95 to 11.0 GHz	Power monitor meter deflects to CAL.	See table 4-3, steps 6A and 13.
3A	Evaluate maximum power output (1107E and 1108E)	Connect test equipment as shown in figure 4-1, test setup B. At the frequencies listed below, check for maximum uncalibrated power output. Set POWER SET control fully counterclockwise. 1107E: 4.00, 6.00, 8.10 1108E: 7.00, 9.00, 11.00	The uncalibrated power outputs for the Models 1107E and 1108E are as follows: 1107E: 4.0 GHz, ⩾ 10 mw 6.0 GHz, ⩾ 10 mw 8.1 GHz, ⩾ 5 mw 1108E: 7.0 GHz, ⩾ 10 mw 9.0 GHz, ⩾ 10 mw 11.0 GHz, ⩾ 10 mw	Refer to paragraph 4-14

TABLE 4-2. MINIMUM PERFORMANCE STANDARDS (Cont'd.)

Step	Purpose	Procedure	Normal Indication	Abnormal Indication Ref.
3B	Evaluate maximum power output (1207E and and 1208E)	Repeat step 3A and check for maximum power output at the frequencies listed below. 1207E: 4.00, 6.00, 8.00 1208E: 6.95, 9.00, 11.00	The uncalibrated power outputs for the Models 1207E and 1208E are as follows: 1207E: 4.0 GHz, ⩾ 60 mw 6.0 GHz, ⩾ 55 mw 8.0 GHz, ⩾ 25 mw 1208E: 6.95 GHz, ⩾ 75 mw 9.0 GHz, ⩾ 30 mw 11.0 GHz, ⩾ 30 mw	Refer to paragraph 4-14
4	Evaluate attenuator accuracy (1107E and 1108E)	Connect test equipment as shown in figure 4-1, test setup C. At the frequencies listed below, check attentuator accuracy at +3.0, −5, −10, −15, and −20 dbm. 1107E: 4.00, 6.00, 8.00 1108E: 6.95, 9.00, 11.00	1107E: ±2 dB, 3.7 to 7.6 GHz ±2.5 dB, >7.6 to 8.2 GHz 1108E: ±2 dB	Refer to paragraph 4-14
5	Evaluate frequency readout accuracy	Connect test equipment as shown in figure 4-1, test setup A. Adjust frequency meter, for dip, to determine signal frequency at the following FREQUENCY GHz readout settings: 1107E/1207E: 3.70, 4.50 1108E/1208E: 7.00, 7.50	Frequency meter reading is within ±0.5% of FREQUENCY GHz readout. 1107E/1207E Limits: 3.682 to 3.718, 4.478 to 4.522 1108E/1208E Limits: 6.965 to 7.035, 7.463 to 7.537	Refer to paragraph 4-25

TABLE 4-2. MINIMUM PERFORMANCE STANDARDS (Cont'd.)

Step	Purpose	Procedure	Normal Indication	Abnormal Indication Ref.
5 Cont.		1107E/1207E: 5.50, 6.50, 7.50, 8.40 1108E/1208E: 8.00, 8.50, 9.00, 9.50, 10.00, 10.50, 11.00 **Note** All frequency checks should be made at an output power level of one milliwatt. Set ΔF control to zero.	1107E/1207E Limits: 5.473 to 5.527; 6.468 to 6.532; 7.463 to 7.537; 8.358 to 8.442 1108E/1208E Limits: 7.960 to 8.040; 8.458 to 8.542; 8.955 to 9.045; 9.453 to 9.547; 9.950 to 10.050; 10.448 to 10.552; 10.945 to 11.055	
6	Evaluate internal square wave operation	Connect test equipment as shown in figure 4-1, test setup D. Set MODULATION SELECTOR switch to INT SQ. WAVE and vary INT SQ. WAVE control. Check square wave frequency with oscilloscope.	Square wave frequency varies typically from 950 to 1050 Hz, minimum	See table 4-3, step 7A or 7B.
7	Evaluate internal FM operation	a. Connect test equipment as shown in figure 4-1, test setup D.		See table 4-3, step 8.

TABLE 4-2. MINIMUM PERFORMANCE STANDARDS (Cont'd.)

Step	Purpose	Procedure	Normal Indication	Abnormal Indication Ref.
7 Cont.		b. Connect the HOR SWP OUT to the EXT SWEEP IN of the oscilloscope. c. Set oscilloscope HORIZONTAL for EXT SWEEP mode. d. Set the EXT SWEEP ATTEN so that it fills the entire horizontal sweep. e. Set the MODULATION SELECTOR switch to INT FM ~ f. Vary the INT FM DEV control.	The entire mode should be swept and the pattern should look like fig.4-5C, when properly phased using the HOR SWP PHASE control. **Note** The sweep may not be symmetrical about the center frequency.	
8	Evaluate external FM operation	Connect test equipment as shown in figure 4-1, test setup D & E.Set MODULATION SELECTOR switch to EXT FM and vary FM AMPLITUDE control on Model 1020A Modulator. Check sweep width with frequency meter.	Sweep width varies with variation in FM AMPLITUDE control.	See table 4-3, step 9.
9	Evaluate external pulse operation	Connect test equipment as shown in figure 4-1, test setups D and F. Set MODULATION SELECTOR switch to EXT ⎍⎍ . Set PULSE WIDTH and RATE controls on 1020A Modulator to desired values. Observe pulses on oscilloscope.	Steady pulses with set pulse width and rate should be observed. **Note** Using Model 1020A as the external pulse source, the modulation duty cycle will be exceeded if a pulse rate higher than approximately 350 Hz is used at the maximum delay of 2000 μsec.	See table 4-3, step 10.

TABLE 4-3. TROUBLESHOOTING PROCEDURE

Step	Purpose	Procedure	Normal Indication	If Indication Is Abnormal
1	Check beam current	a. Set digital multimeter for 20v range. Connect pin 4 of the test connector A4TP1 (provided as an accessory) to V-Ω of the multimeter and pin 2 to the COMMON. b. Set MODULATION SELECTOR switch to CW. c. Allow instruments to warm up for 20 minutes. d. Scan through the frequency range.	Multimeter will indicate 2.1 to 2.6. Proceed to step 2.	Refer to paragraph 4-22. Check klystron tube V1 and associated circuitry. Check voltage and resistance values listed in Table 5-1.
2	Check beam power supply voltage	a. Set differential voltmeter and voltbox for 5000 dc volt range. b. Connect voltmeter + lead to chassis and - lead to pin 2 of connector A3A1J8.	Differential voltmeter will indicate a beam power supply voltage of -1250 volts ±1%. Proceed to step 3.	Refer to paragraph 4-20.
3	Check repeller power supply voltage	a. Disconnect voltmeter - lead from pin 2 of connector A3A1J8 and connect it to pin 3 of A3A1J5. b. Turn ΔF control fully clockwise. **Note** Return ΔF control to "0" position after test.	Voltmeter will indicate a repeller power supply voltage of 1750/1850 volts ±1%. Proceed to step 4.	Refer to paragraph 4-21.

TABLE 4-3. TROUBLESHOOTING PROCEDURE (Cont'd.)

Step	Purpose	Procedure	Normal Indication	If Indication Is Abnormal
4	Check 40-volt power supply	a. Set digital voltmeter for 200 volt dc range. b. Connect V-Ω lead of digital multimeter to pin 3 of A3A1J8 and common lead to pin 4 of A3A1J8.	Voltmeter will indicate 40 volts ±10%. Proceed to step 5.	Check A5BR1 and associated circuitry
5	Check klystron filament supply voltage	a. Disconnect multimeter. b. Set multimeter for 20-volt dc range. c. Connect multimeter COMMON lead to pin 3 of connector A3A1J3 and V-Ω lead to pin 2 of A3A1J3.	Voltmeter will indicate approximately 6.3 volts. Proceed to step 6.	Check A3A1BR1 and A3A1U1 and associated circuitry.
6A	Check cw operation. (Models 1107E and 1108E only)	a. Disconnect multimeter. b. Set FREQUENCY GHz dial to low end of range. c. Adjust POWER SET control for a power monitor indication of CAL. d. Adjust FREQUENCY GHZ dial upward in 200 MHz increments and repeat step c at each increment.	Power monitor indication of CAL can be obtained over entire frequency range. Proceed to step 7A.	Check V1, A3A1S1, A3A1U2, A3A1Q1 and associated circuitry. Check Level Detector Z1,A8M1 and associated circuitry.
6B	Check cw operation. (Models 1207E and 1208E only)	a. Disconnect multimeter. b. Connect test equipment as shown in figure 4-1, test setup B.	Power meter indications for Models 1207E and 1208E should be as follows over their respective frequency ranges.	Check V1, A3A1S1, A3A1U2, A3A1Q1 and associated circuitry.

TABLE 4-3. TROUBLESHOOTING PROCEDURE (Cont'd.)

Step	Purpose	Procedure	Normal Indication	If Indication Is Abnormal
6B Cont.		c. Set FREQUENCY GHz dial to low end of range. d. Adjust the ATTENUATOR control on the Model 1207E and 1208E for the following indications when checking the frequency range of the instruments: 1207E: 3.7 to 4.3 GHz, ⩾60 mw 4.3 to 5.0 GHz, ⩾25 mw 5.0 to 6.6 GHz, ⩾55 mw 6.6 to 8.4 GHz, ⩾25 mw 1208E: 6.95 to 8.00 GHz, ⩾75 mw 8.00 to 11.0 GHz, ⩾30 mw	1207E: 3.7 to 4.3 GHz, ⩾ 60 mw 4.3 to 5.0 GHz, ⩾ 25 mw 5.0 to 6.6 GHz, ⩾ 55 mw 6.6 to 8.4 GHz, ⩾ 25 mw 1208E: 6.95 to 8.00 GHz, ⩾ 75 mw 8.00 to 11.0 GHz, ⩾ 30 mw Proceed to step 7B.	
7A	Check internal square wave operation (Models 1107E 1108E only)	a. Connect test equipment as shown in figure 4-1, test setup D. b. Set FREQUENCY GHz dial to mid-range. c. Adjust POWER SET control for a power monitor indication of CAL. d. Set MODULATION SELECTOR switch to INT SQ. WAVE. e. Vary INT SQ. WAVE control over its range.	Power monitor indication will change approximately −3 or less when MODULATION SELECTOR switch is set to INT SQ WAVE. Square wave varies typically from 950 to 1050 Hz	Check A3A1U3, A3A1U4 and associated circuitry.

TABLE 4-3. TROUBLESHOOTING PROCEDURE (Cont'd)

Step	Purpose	Procedure	Normal Indication	If Indication Is Abnormal
7B	Check Internal square wave operation. (Models 1207E and 1208E)	a. Connect test equipment as shown in figure 4-1,test setup D. b. Set FREQUENCY GHz dial to mid-range. c. Adjust ATTENUATOR control on Models 1207E/1208E for an indication of 1 milliwatt. d. Set MODULATION SELECTOR switch to INT SQ WAVE. e. Vary INT SQ WAVE control over its range.	Square waves with a frequency range of 950 to 1050 Hz, should be observed.	Check A3A1U3, A3A1U4 and associated circuitry.
8	Check internal fm operation	a. Connect test equipment as shown in figure 4-1,test setup D. b. Connect the HOR SWP OUT to the EXT SWEEP IN of the oscilloscope. c. Set oscilloscope HORIZONTAL DISPLAY to EXT SWEEP mode. d. Set the EXT SWEEP ATTEN so that it fills the entire horizontal sweep. e. Set the MODULATION SELECTOR switch to INT FM~. f. Vary the INT FM DEV control.	The entire mode should be swept and the pattern should be like figure 4-5C, when properly phased using the HOR PHASE control.	Check 2T1, A3A3R16, A3A1S1 and associated circuitry.

TABLE 4-3. TROUBLESHOOTING PROCEDURE (Cont'd.)

Step	Purpose	Procedure	Normal Indication	If Indication Is Abnormal
9	Check external fm operation.	a. Connect test equipment as shown in figure 4-1, test setups D and E. b. Set MODULATION SELECTOR to EXT FM. c. Set 1020A Modulator pulse rate to 1000 Hz approximately. d. Vary FM DEV AMPLITUDE control on Modulator 1020A.	Sweep width varies with variation in FM DEV AMPLITUDE control.	Check A3A1S1 and associated circuits.
10	Check external pulse operation.	a. Connect test equipment as shown in figure 4-1, test setups D and F. b. Set MODULATION SELECTOR switch to EXT ⎍ ⎍ c. Set PULSE WIDTH and RATE controls on Model 1020A Modulator to any desired value. Observe pulses on oscilloscope.	Steady pulses with set pulse width and rate should be observed. **Note** Using Model 1020A as the external pulse source, the modulation duty cycle will be exceeded if a pulse rate higher than approximately 350 Hz is used at the maximum delay of 2000 μsec.	Check A3A1S1,A3A1Q1, A3A1U2 and associated circuitry.
11	Check attenutator operation.	a. Connect test equipment as shown in figure 4-1, test setup B. b. Set MODULATION SELECTOR to CW. c. Vary ATTENUATOR control.	Power meter indication will vary in unison with rotation of ATTENUATOR control.	Refer to paragraph 4-14.

TABLE 4-3. TROUBLESHOOTING PROCEDURE (Cont'd.)

Step	Purpose	Procedure	Normal Indication	If Indication Is Abnormal
12A	Check RF OFF function (Models 1107E,1108E)	Set MODULATION SELECTOR to RF OFF.	Power monitor and power meter indicate zero	Adjust mechanical zero adjustment of A8M1. Check A3S1 circuits.
12B	Check RF OFF function (Models 1207E,1208E)	Same as step 12A, test setup B	Power meter indicates zero.	Check A3A1S1 circuits.
13	Check power monitor operation (Models 1107E, 1108E only)	a. Set MODULATION SELECTOR switch to CW. b. Vary POWER SET control.	Power monitor indication varies from −3 to +3 smoothly.	Check meter A8M1 and associated circuitry.

4-13. REMOVAL OF ATTENUATOR PROBE ASSEMBLY. To remove the attenuator probe assembly (see figure 4-8), and proceed as follows:

a. Rotate knob to withdraw probe from pipe.

b. Unfasten and remove the cable clamp that secures the attenuator probe cable to the casting.

c. Loosen setscrews in attenuator probe collar.

d. Carefully pull the probe out of the collar.

e. Remove the screws that secure RF OUTPUT connector J5.

f. Feed the connector J5 back out of the panel.

g. Unthread the attenuator probe assembly through the casting hole.

4-14. REPLACEMENT OF ATTENUATOR PROBE ASSEMBLY. To replace the attenuator probe assembly, proceed as follows:

CAUTION

ADVANCING THE ATTENUATOR PROBE TOO DEEPLY (MODEL 1108E ONLY) INTO THE KLYSTRON CAVITY WILL DAMAGE THE CAVITY.

a. With the grounded side of the probe to the front for Model 1207E and to the rear for Models 1107E/1108E/1208E, thread the attenuator probe assembly cable W15 through the casting hole provided, with connector J5 positioned near its mounting holes and the probe tip adjacent to the probe collar. Insert the probe tip through the probe collar and into the attenuator barrel. Rotate the ATTENUATOR control fully clockwise. Push the attenuator in gently until it stops. Back off slightly and tighten the setscrews. Care should be taken not to hit the mode suppressors on the Model 1108E or klystron tube on all the other models. Tighten the setsecrews on probe collar.

b. Mount and fasten RF OUTPUT connector J5.

c. Replace the cable clamp.

d. Rotate the ATTENUATOR control to withdraw the probe. Switch the POWER switch to ON. Set MODULATION switch to CW.

e. Connect power meter to instrument (figure 4-1, test setup B) and check maximum power output across the frequency range. If the power is below specification, it might be necessary to rotate or replace the klystron tube. Be sure to check pulsing after maximum power is obtained.

f. Tune the signal generator to the midpoint of its frequency range, and rotate the ATTENUATOR control fully ccw until RF output is 0 dBm.

g. Loosen the setscrews on the attenuator dial hub and rotate the sliding dial to line up 0 dBm marking on the dial with the power set hairline.

h. Tighten the setscrews on the attenuator dial hub.

i. Tune the signal generator across its entire frequency range. Note the highest and lowest power output points with reference to 0 dBm.

j. Using the two reference points measured in step i, adjust the output accuracy at 0 dBm (release setscrew and slide attenuator dial) so that the two referenced points are equidistantly centered around 0 dBm.

k. After desired results are obtained, lock both setscrews.

l. Adjust the signal generator frequency to midpoint on the band.

m. Check the output accuracy at 0 dBm and −50 dBm. If a compromise between the two lower power levels is necessary, readjust the attenuator dial and/or A3R31.

n. Adjust the generator frequency to several points above and below the reference established in step l.

o. Repeat step m for a compromise in output accuracy at the frequency reference points established in step p. **Note:** When repeating step m for the Model 1107E, A3R54 is adjusted between 3.7 GHz and 7.45 GHz. (1¾ and 2¾ modes) and A3R31 is adjusted from 7.45 GHz to 8.2 GHz (3¾ mode).

p. Disconnect power meter.

Note

Models 1207E and 1208E: Operate instrument to determine frequency at which minimum power output is obtained and rotate the ATTENUATOR control fully ccw, i.e., collar closest to barrel. Adjust probe insertion until power meter reading just starts to drop after reaching a peak, then tighten setscrew in probe collar.

4-15. REMOVAL OF POWER SET PROBE ASSEMBLY (MODELS 1107E AND 1108E ONLY). To remove the power set probe assembly (see fig. 4-10) proceed as follows:

a. Rotate the POWER SET control fully ccw. Also rotate the ATTENUATOR control fully clockwise.

b. Unfasten and remove the cable clamp that secures the power set probe cable W9.

c. Disconnect connector W9P7 from level detector Z1.

d. Loosen the setscrew that secures the power set probe in the probe lock.

e. Carefully slide the probe out of the power set pipe on the klystron cavity.

f. Remove the power set probe assembly from the instrument.

4-16. REPLACEMENT OF THE POWER SET PROBE ASSEMBLY (MODELS 1107E AND 1108E ONLY). To replace the power set probe assembly, proceed as follows:

a. Rotate ATTENUATOR control fully clockwise and rotate the POWER SET control fully clockwise.

b. Place the instrument on its left side to bring the probes uppermost and accessible.

c. With the grounded side of the probe tip towards the rear, insert the probe end through the probe block into the power set pipe on the klystron cavity. Push the probe in until it just touches the the mode supressor and back off slightly. Tighten the setscrew (as in paragraph 4-15d).Slip the connector end of the power set probe assembly through the space between the attenuator probe and the side frame. Rotate both probe controls counterclockwise.

CAUTION

ADVANCING THE POWER SET PROBE TOO DEEPLY (MODEL 1108E ONLY) INTO THE KLYSTRON CAVITY WILL DAMAGE THE CAVITY.

d. Connect probe connector A7P1 to the microwave power meter (figure 4-1, test setup C) and adjust the power meter for 3 mw range. Switch the POWER switch to ON and operate in CW mode of operation (see paragraph 2-10).

e. Tune the instrument over its range and determine the frequency at which the minimum power output occurs.

f. With the instrument tuned to the frequency at which minimum output power is obtained, adjust the RF ATTENUATOR control for an output power of 0 dBm (use setup C,figure 4-1). Set hairline of POWER SET control in line with 0 on attenuator dial.

g. Loosen the setscrews that secure the POWER SET in the probe block and adjust the amount of probe insertion in the barrel for a power meter indication of 1.5 mw.

CAUTION

GROUND MUST BE TO THE REAR

h. Tighten the setscrew that secures the power set probe in the probe block.

i. Disconnect the power meter.

j. Depress power set cable W9 toward level detector Z1.

k. Install and fasten the cable clamp around W9.

l. Connect connector W9P7 to level detector Z1.

4-17. REPLACEMENT OF KLYSTRON OSCILLATOR TUBE V1. To replace klystron oscillator tube V1 (figure 4-2 or 4-2A), proceed as follows:

WARNING

BEFORE REPLACING KLYSTRON, DISCONNECT POWER CORD.

a. Adjust frequency to low end of range.

b. Loosen klystron cover holding clamp and remove cover carefully. Disconnect klystron socket from tube.

c. Place the instrument resting on its front handles and hold or secure in this position.

d. Loosen the knurled nut with a spanner wrench (Polarad P/N AP15550).

e. Remove the knurled nut.

f. Extract the old klystron from the cavity by screwing the klystron clockwise and pulling it out of the cavity at the same time.

g. Remove the spacer, washer and springs. Remove the springs from the cores, and replace with the new ones supplied with the replacement klystron. Note that the new springs are stiff. Stretch the springs slightly until they are no longer stiff, but droop slightly. When stretching the springs, use care since they stretch easily, and overstretching **cannot** be corrected.

h. Cut approximately 1/8 inch from each end with sharp cutters. Push the spring around the core. If the spring has been cut properly, the opening across the two ends of the spring will be 1/16 inch or less. If the opening is larger, stretch the spring a little more. If the opening is less, cut a little off one end.

i. Repeat the above for the other spring and core.

j. Insert one spring and core into the cavity with the open end to the right.

k. Insert the thin washer.

l. Insert the other spring and core into the cavity with the open end to the left.

m. Insert the large spacer and screw on the knurled nut all the way by hand; then back off the nut one-half of a turn so that it is loose.

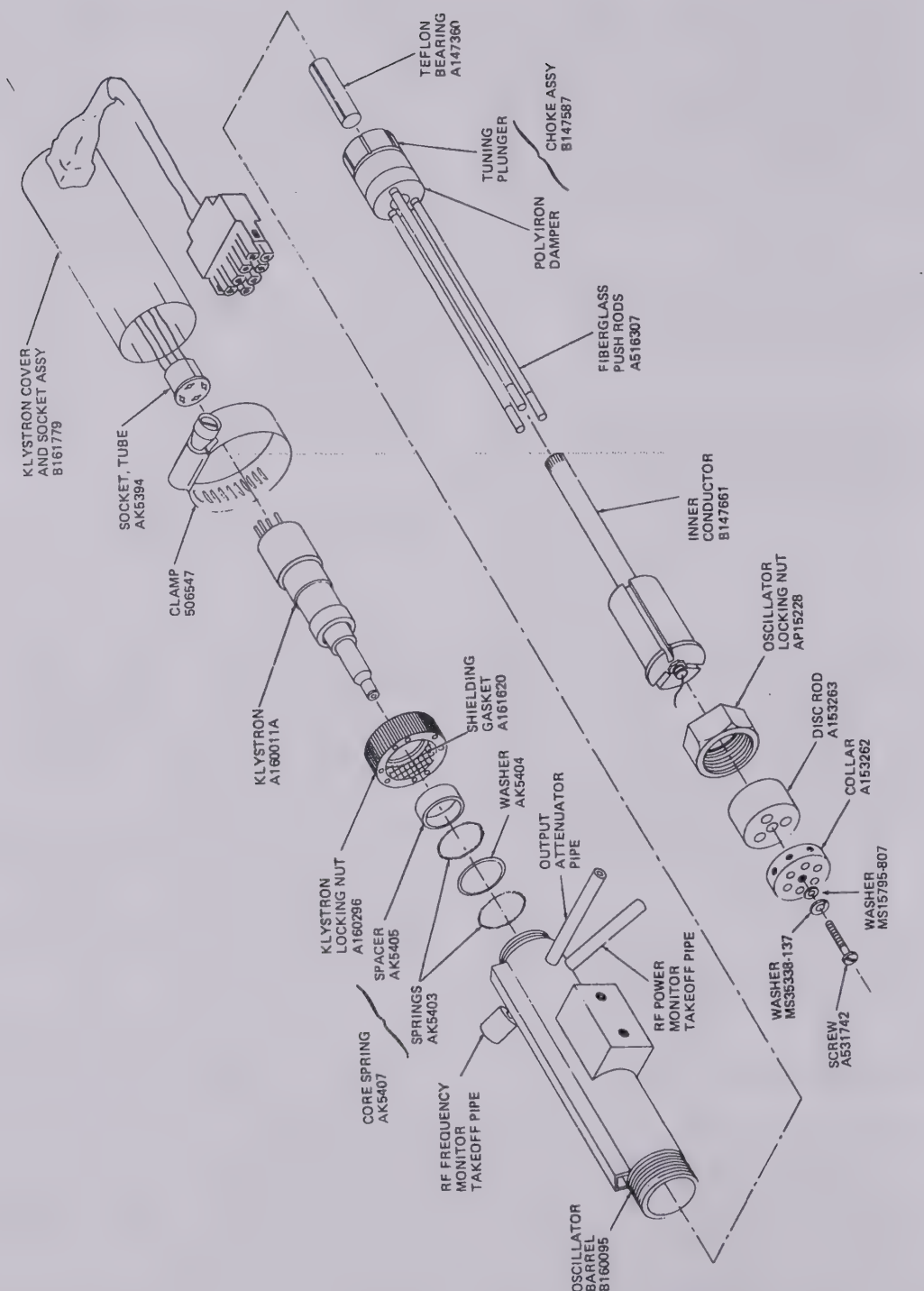


Figure 4-2. Klystron Cavity, Exploded View (Models 1107E and 1207E)

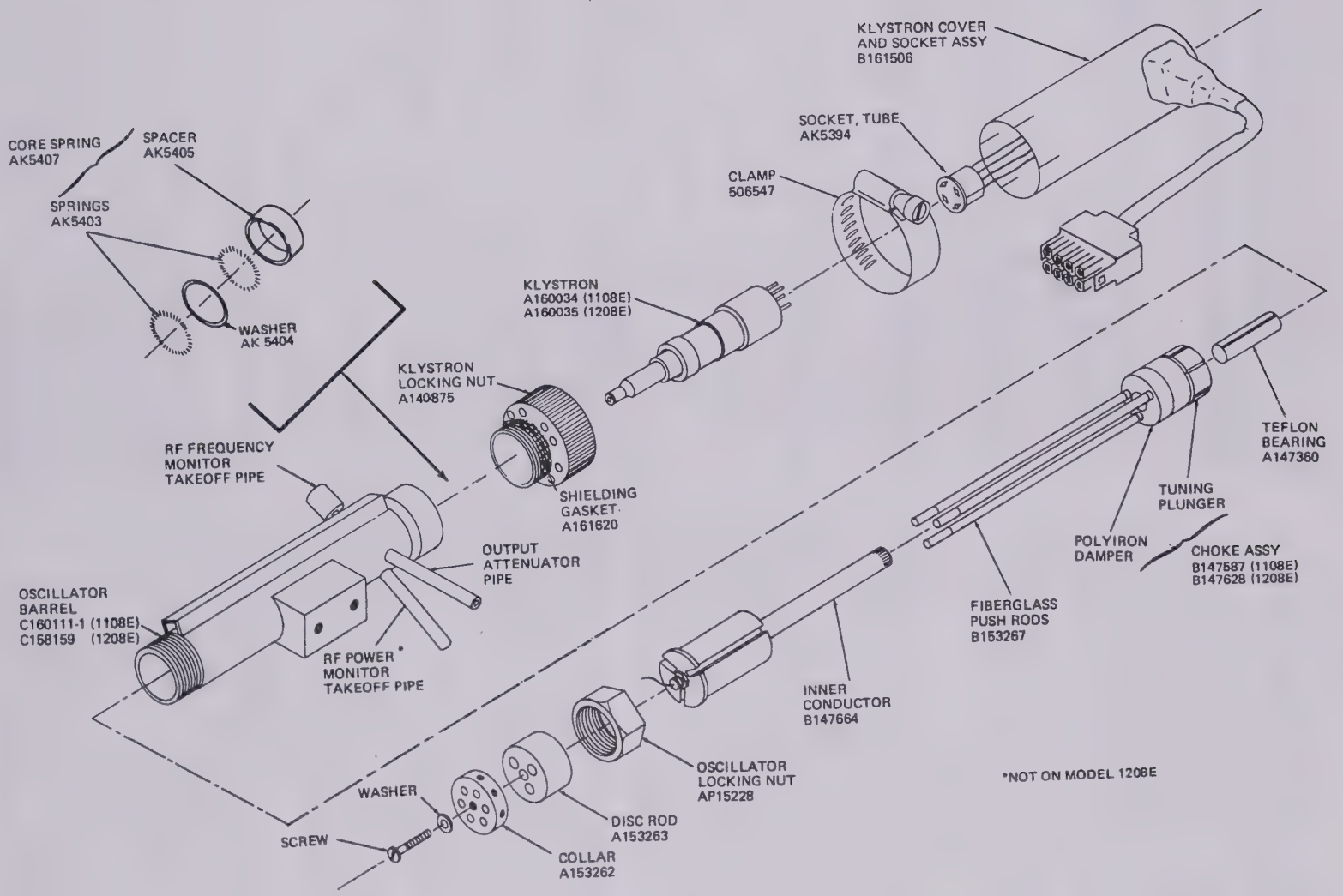


Figure 4-2A. Klystron Cavity, Exploded View (Models 1108E and 1208E)

n. Insert the new klystron into the cavity by pushing straight in until it stops.

o. Rotate the klystron slightly **clockwise**, and push simultaneously until the tube suddenly moves forward and a distinct click is heard. If the tube does not move forward or a grinding sound is heard, the springs have not been stretched enough. This should be corrected by repeating steps e through o.

p. Back off knurled nut 1/4 turn in a counterclockwise direction.

Note

It should also be noted that when pushing the tube, a fair amount of force is required. If the klystron is pushed straight in and NOT on an angle, this force will not harm it.

q. The tube is now passed over the first spring. Continue rotating the tube slightly **clockwise** and pushing the tube until the tube moves in again and another click is heard. Now rotate the tube 1/4 turn clockwise, and hand-tighten the knurled nut. After making electrical tests, tighten knurled nut with spanner wrench an additional 1/4 turn.

r. Attach extension cable (Polarad No. A160465) between the klystron and the cover socket. (An extension cable may be fabricated using Amphenol Socket 78-S4S and Plug 71-4S.) Use vinyl electrical tape around soldered pins. These points are at dangerous voltages.

s. Align the unit in accordance with the procedures outlined in paragraph 4-18 through 4-27.

4-18. ADJUSTMENT AND CALIBRATION PROCEDURES. (See paragraph 4-30 for use of the Test Connector as an aid in making test measurements.)

4-19. Instrument adjustment and calibration procedures are given in paragraph 4-20 through 4-27. After performing any of the adjustment and calibration procedures given below, perform the minimum performance checks given in table 4-2. Connect power cord to ac source and switch POWER switch to the on position.

WARNING
HIGH VOLTAGES ARE PRESENT AND PROPER SAFETY PRECAUTIONS MUST BE EXERCISED WHEN MAKING ANY ADJUSTMENTS

4-20. −1250 VOLT ADJUSTMENT. To adjust the −1250 volt supply, set the instrument for CW operation and proceed as follows:

a. Rotate BEAM CURRENT ADJ A5A2R5 to midpoint.

b. Set digital multimeter to 20 VDC range. Connect pin 4 of the test connector A4TP to V-Ω of the multimeter and pin 2 to COMMON.

c. Adjust BEAM CURRENT ADJ A5A2R5 for an indication of 2.50V on the multimeter (see figure 4-13 for location of A5A2R5).

d. Set differential voltmeter for 6000-volt dc range, connect + lead to chassis, and − lead to pin 2 of connector A3A1J8.

e. Adjust the H.V. ADJ control A4R21 for 1250 volts (see figure 4-12 for location of A4R21).

f. Glyptol-lock the potentiometer A4R21.

g. Disconnect the differential voltmeter.

4-21. −1750/−1850 VOLT ADJUSTMENT. To adjust the −1750/−1850 volt supply, set the instrument for CW and proceed as follows:

a. Set differential voltmeter for 6000-volt dc range, connect + lead to chassis, and the − lead to pin 3 of connector A3A1J5 and turn ΔF control fully clockwise.

b. Adjust the −1750/−1850 control A3A1R42 for 1750/1850 volts (see figure 4-11 for location of A3A1R42).

c. Glyptol-lock potentiometer A3A1R42.

d. Disconnect the differential voltmeter.

e. Return the ΔF control to the center "0."

4-22. BEAM CURRENT ADJUSTMENT. To adjust the beam current after adjusting the −1250 and −1750/−1850 volt supplies, set the instrument for CW operation and proceed as follows:

a. Set digital multimeter to the 20 VDC range. Connect pin 4 of the test connector A4TP to V-Ω of the multimeter and pin 2 to COMMON.

b. Adjust BEAM CURRENT ADJ control A5A2R5 for 2.50 V on the multimeter.

c. Scan through the frequency band and readjust so that 2.50 V is minimum at any point.

d. Glypto-lock BEAM CURRENT ADJ potentiometer A5A2R5.

e. Disconnect the multimeter with the tube oscillating.

4-23. FILAMENT VOLTAGE ADJUSTMENT. To adjust the filament voltage proceed as follows:

a. Connect the digital voltmeter to pin 2 of connector A3A1J3 and the COMMON lead to pin 3 of connector A3A1J3.

b. Adjust 6.3 ADJ control A3A1R1 for +6.3 volts (see figure 4-11 for location of A3A1R1).

4-24. INT FM DEV RANGE ADJUSTMENT. To adjust the range of INT FM DEV control, set instrument for CW mode of operation and proceed as follows:

a. Set MODULATION SELECTOR switch to INT FM~.

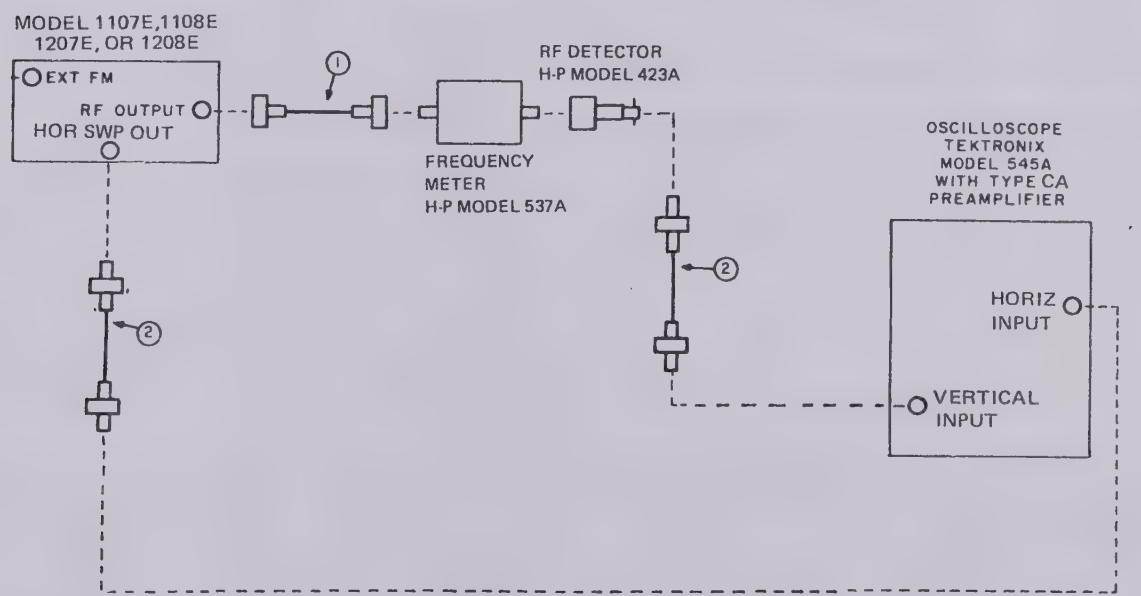
b. Connect equipment as shown in figure 4-3.

c. Adjust the INT FM DEV control fully counterclockwise.

d. Adjust HOR SWP PHASE control so that mode pattern of figure 4-5C is obtained.

e. Adjust INT FM DEV range adjustment A3A1R17 so that complete mode patterns can be observed of the respective model (see figure 4-11 for location of A3A1R17).

4-25. KLYSTRON FREQUENCY ALIGNMENT. Due to variations in klystron repeller voltage characteristics and other parameters, the tuning cam and repeller voltage



(1) RF CABLE P/N B12551 SUPPLIED WITH MODELS 1107E, 1108E, 1207E, 1208E
(2) VIDEO CABLE P/N B12553 (OPTIONAL)

Figure 4-3. Test Setup for Klystron Frequency and Repeller Tracking Adjustments

adjustments must be made whenever the klystron is replaced or the performance of the instrument doesn't meet the minimum performance requirements of table 4-2. To align the klystron for frequency and repeller voltage tracking, proceed as follows:

Note

The voltage and current adjustments of paragraphs 4-20 through 4-24 must be performed before klystron alignment is begun.

a. Connect test equipment as shown in figure 4-3.

Note

If a component in the repeller voltage tracking circuitry has been replaced, or the glyptol locks of the tracking potentiometers have been broken, set all tracking potentiometers to their typical repeller voltage as indicated in figure 4-6 or 4-7. If only the klystron has been replaced, this preliminary rough setting is not required.

b. Set MODULATION SELECTOR switch to INT FM~.

c. Apply power to instrument and test equipment and allow them to warm up for 15 minutes.

d. Rotate frequency control knob to position the cam follower at the fixed point on the tuning cam shown in figure 4-4.

Note

Set ΔF control at "0."

e. Check the FREQUENCY GHz readout. It should be about 5.8 GHz for Models 1107E and 1207E or 8.85 GHz for Models 1108E and 1208E.

f. Adjust attenuator output level, INT FM DEV and HOR SWP PHASE controls and oscilloscope to obtain a stable display of the klystron mode pattern, similar to figure 4-5, pattern C.

g. Tune frequency meter to place dip due to frequency meter at peak of mode pattern as shown in figure 4-5, pattern D.

h. Frequency meter reading should be within ±0.1% of FREQUENCY GHz readout. If it is not, loosen the socket head screw in the cam follower yoke (figure 4-8) and adjust push rod yoke to bring frequency within tolerance. Retune frequency meter to check push rod yoke adjustment and then tighten socket head screw.

i. The klystron tube must now be rotated for maximum output. The extension cable should be inserted as described in paragraph 4-17r. and the knurled nut loosened.

j. Slowly tune the frequency to the top of the frequency range (8.4 GHz or 11.0 GHz) while observing the mode pattern.

k. If the mode pattern disappears before the high end is reached, the rotation will start at that point. Be sure that the attenuator is not too far in to collapse the mode pattern. If the mode pattern is present to the highest frequency, the rotation of the klystron will proceed at 8.4 GHz or 11.0 GHz.

CAUTION

WEAR A HIGH INSULATION GLOVE DURING THE KLYSTRON ROTATION TO PROTECT AGAINST HEAT AND ELECTRICAL SHOCK

l. Rotate the klystron slowly clockwise while observing the mode pattern display. Stop rotating when the center mode pattern is at its greatest amplitude. The total rotation should not be more than 270°.

m. Switch the POWER switch to its OFF position and tighten the klystron knurled nut. Remove the jumper cable, reconnect the klystron socket to the klystron base and replace the klystron cover.

n. Switch the POWER switch to on and after the proper time delay (60 seconds approximately).Repeat step e and then continue with step o and the other following steps.

o. Rotate the frequency control knob to position eccentric adjustment 4 (figure 4-4) opposite the cam follower. Tune frequency meter to check instrument frequency, which should be within ±0.1% of FREQUENCY GHz readout. If frequency is not within tolerance, loosen the four screws (three screws on Models 1108E and 1208E) on the top of the tuning cam for adjustments 4, 5, 6, and additionally 7 for Models 1107E and 1207E.

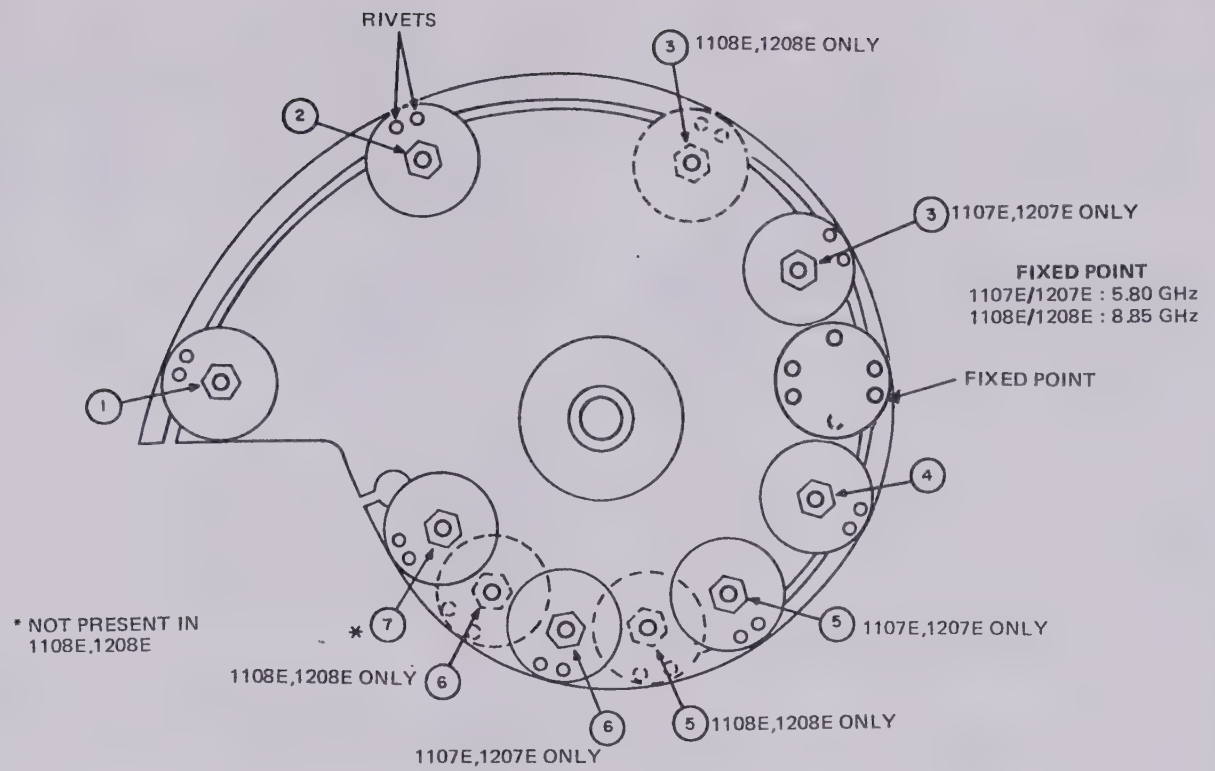
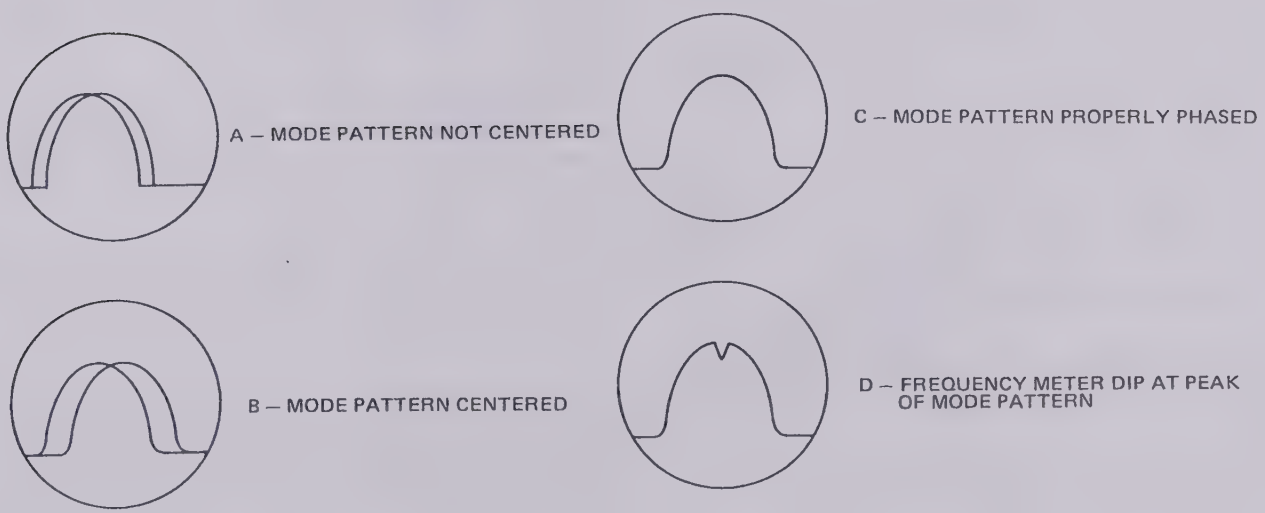


Figure 4-4. Tuning Cam Adjustments


A – MODE PATTERN NOT CENTERED
C – MODE PATTERN PROPERLY PHASED
B – MODE PATTERN CENTERED
D – FREQUENCY METER DIP AT PEAK
OF MODE PATTERN

Note: Patterns shown are for positive detected voltage RF Detector.
For negative detector, the patterns will be in the downward direction.

Figure 4-5. Mode Patterns

Note

If adjustment 4 requires change, loosen all four screws. If only one of the other adjustments require change, loosen that screw only and take care that the cam is not distorted.

p. To bring the instrument frequency within tolerance for adjustment 4, set frequency meter to the FREQUENCY GHz readout value for adjustment 4. Adjust hex nut 4 until the frequency is within tolerance. Recheck the frequency after tightening adjustment, and, if necessary, repeat adjustment after loosening screw on the top of the tuning cam.

q. Rotate frequency control knob to position eccentric adjustment 5 opposite the cam follower. Repeat procedure of steps o, p, and q for adjustment 5, 6, and 7 (Models 1107E and 1207E).

r. After making adjustment 7, recheck all frequencies for adjustments 6, 5, and 4.

s. Repeat step d. Frequency should be within ±0.5% of FREQUENCY GHz readout.

t. Rotate frequency control knob to position eccentric adjustment 3 opposite the cam follower. Instrument frequency should be within ±0.5% of the FREQUENY GHz readout. If frequency is not within tolerance, loosen the three screws on the top of the tuning cam for adjustments 3, 2, and 1.

u. To bring the instrument within tolerance, adjust hex nut 3 until frequency is within tolerance, then tighten screw on the top of the cam while holding adjustment 3 with a wrench. Tighten all top screws after adjustment.

v. Repeat steps t and u for adjustments 2 and 1.

w. After making adjustment 1, recheck all frequencies for adjustments 1, 2, and 3. If necessary, repeat steps t, u, and v.

x. Leave test setup operating for repeller tracking adjustments.

4-26. REPELLER VOLTAGE TRACKING ADJUSTMENTS. After completing the klystron frequency alignment of paragraph 4-25, proceed with the repeller voltage tracking adjustment given below. If the proper mode pattern is obtained prior to adjustment, omit the adjustment. The typical repeller voltage vs. frequency characteristics for Models 1107E and 1207E are shown in figure 4-6 and the typical repeller voltages vs. frequency characteristics for Models 1108E and 1208E are shown in figure 4-7.

a. Rotate the frequency control knob to the low end of the frequency range of the instrument.

Models 1107E and 1207E — 3.70 GHz
Models 1108E and 1208E — 6.95 GHz

b. Set MODULATION SELECTOR switch to INT FM~.

c. Adjust HOR SWP PHASE control to obtain a single trace, of the mode pattern, as in C of figure 4-5. If the mode pattern appears as A in figure 4-5, the repeller voltage is not correct for the klystron frequency. Adjust LOW potentiometer A6R1 to center the mode pattern, as in B of figure 4-5.

d. Rotate the frequency control knob to the point just before the mode switch A7S1 operates. If necessary adjust LOW MODE potentiometer A6R2 to center the mode pattern.

e. Models 1108E and 1208E. Rotate the frequency control knob to the point just after the mode switch A7S1 operates. If necessary, adjust HIGH MODE potentiometer A6R3 to center the mode pattern.

f. Models 1108E and 1207E. Rotate the frequency control knob to the high end of the frequency range of the instrument. Adjust HIGH potentiometer A6R4 to center the mode pattern.

g. Models 1107E and 1207E. Rotate the frequency control knob to the point just after the mode switch A7S1 operates. Adjust TRACK 1 potentiometer A6R3 to center the mode pattern.

h. Models 1107E and 1208E. Rotate the frequency control knob to the point just before the mode switch A7S2 operates. If necessary, adjust TRACK 2 potentiometer A6R4 to center the mode pattern.

i. Models 1107E and 1207E. Rotate the frequency control knob to the point just after the mode switch A7S2 operates. If necessary, adjust HIGH MODE potentiometer A6R5 to center the mode pattern.

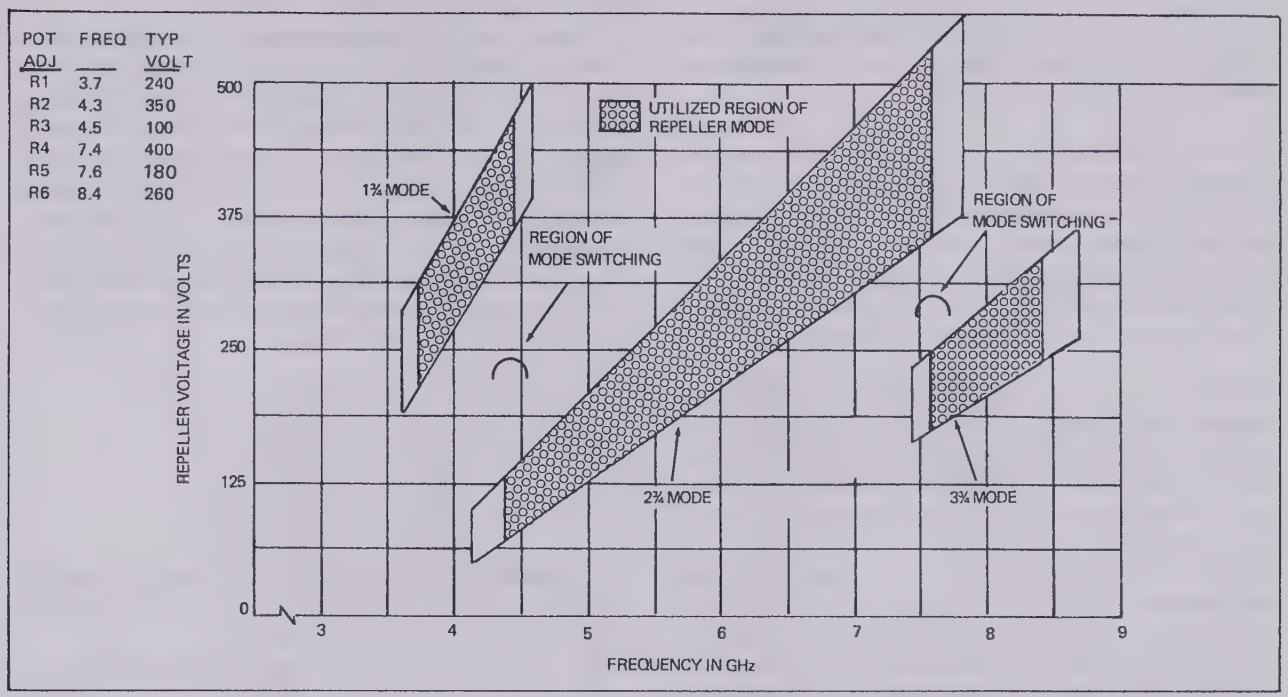


Figure 4-6. Typical Repeller Voltage Vs. Frequency Characteristics, Models 1107E and 1207E

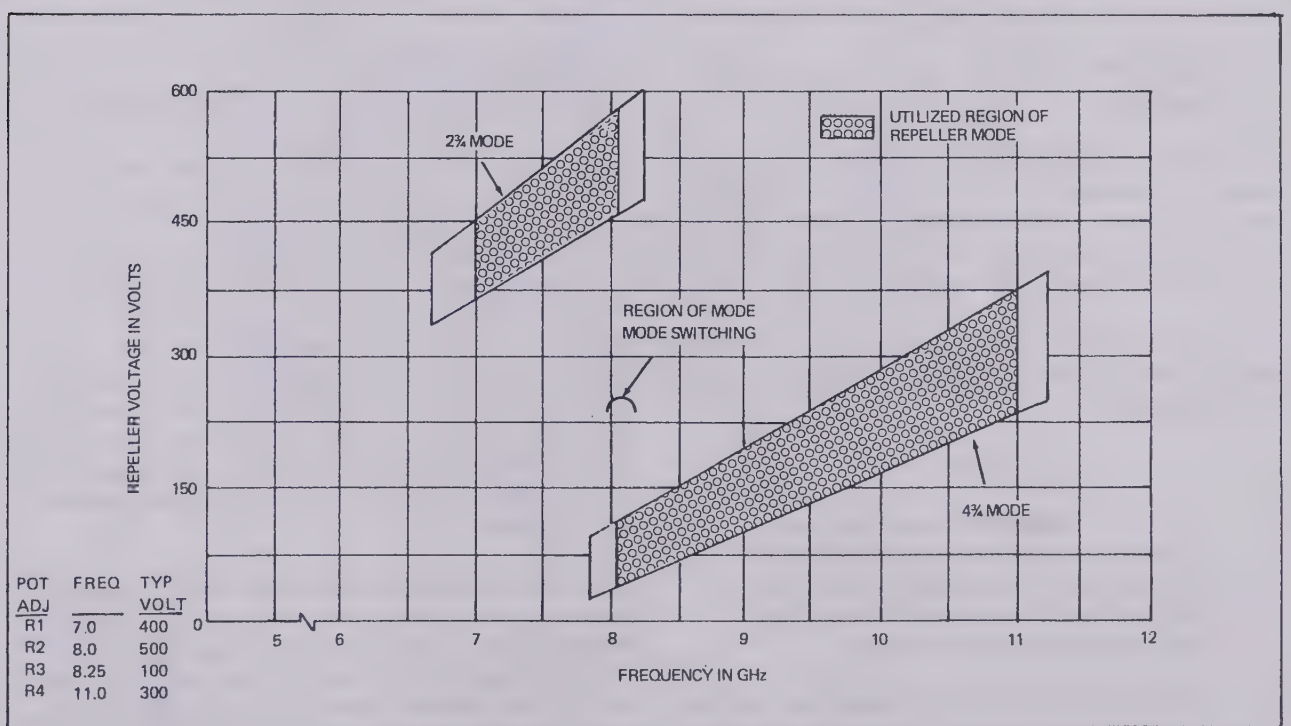


Figure 4-7. Typical Repeller Voltage Vs. Frequency Characteristics, Models 1108E and 1208E

j. Models 1107E and 1207E. Rotate the frequency control knob to the high end of the frequency range of the instrument. If necessary, adjust HIGH potentiometer A6R6 to center the mode pattern.

k. Rotate the frequency control knob to cover the complete frequency range of the instrument. The mode pattern, displayed on the oscilloscope, should be continuous, should remain centered, should not split into a double pattern, and should not exhibit a loss of power at any point in the frequency range. However, there should be an abrupt change in power level at the mode switching points.

l. It may be necessary to fine adjust the tracking potentiometers A6R1 through A6R4 for Models 1108E and 1208E and A6R1 through A6R6 for Models 1107E and 1207E for minimum pulse jitter. To adjust for minimum pulse jitter, use test setup F of figure 4-1. Adjust the external modulation source for 0.5μsec pulsewidth and scan through the frequency band. If at any frequency point (band), the pulse jitter exceeds 0.2 μsec, readjust the tracking potentiometer associated with that frequency. For example, if pulse jitter at 8.20 GHz is observed in Models 1108E/1208E, A6R3, the HIGH MODE potentiometer should be readjusted until the pulse jitter is minimum.

m. Glyptol-lock the shafts of all the tracking potentiometers.
(Models 1107E and 1207E – A6R1 through A6R6)
(Models 1108E and 1208E – A6R1 through A6R4)

4-27. MODELS 1107E and 1108E ONLY. If the power monitor meter A8M1 does not indicate CAL when the output level at the RF OUTPUT connector J5 is 0 dBm or 1 mw and the POWER SET dial is set, adjust METER CAL control A3A1R31 for a meter indication of CAL.

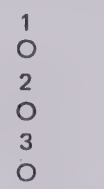
4-28. POWER OUTPUT CHECK. To check the power output of the instrument, perform steps 1, 3A or 3B, and 4 of table 4-2.

Note

If the probe is allowed to remain at a fixed position for all frequencies, it is possible that at some frequencies, the oscillator will stop oscillating. At these points, the probe should be retracted and reset for maximum output.

4-29. FINAL CHECK. To check the overal performance of the instrument, perform steps 3 and 6 through 9 of table 4-2. Replace the top, bottom, and right side dust covers.

4-30. ACCESSORY TEST CONNECTOR. The Test Connector, A713772, supplied as part of the accessory kit, is used to assemble a test cable to aid in evaluation of the performance of the signal generator and implement voltage adjustments. The cable may have a length of up to four feet without affecting performance. Under normal operating conditions, voltages should be below +40 volts. A failure, however, in the High Voltage Box A5 could bring this level up to several hundred volts. Caution should, therefore, be used when locating the end of the cable and when making measurements. Viewing from the top of the connector, the pin numbers will be as follows:



The following voltage table indicates normal operation, when the MODULATION SELECTOR switch is in the CW position and the voltage is at 115 vac.

	Pin Nos.	Indication	Tol
Klystron Beam Current	4(+) to 2	2.7 vdc	±10%**
Low Voltage DC Power Supply Voltage	1(+) to 2	31 vdc	±10%
Low Voltage DC Power Supply Current	5(+) to 1	450mvdc	±10%***
*Low Voltage Bias	6(+) to 2	12 vdc	±10%

*The bias voltage must be read during the first minute after turning on the set (klystron filament warmup interval before the high voltage is applied).
**This is equivalent to 27 ma going through A5A1R8.
***This is equivalent to 2.25 amp going through A4R1.

After checking the voltages listed in the above table, monitor the klystron beam current (pins 4 and 2). With the MODULATION SELECTOR switch in the CW position, the voltage should be between 2.5 and 2.9 volts. Push in RF OFF control and the voltages should drop to 0.4 volts. Push in IN SQ WAVE control and the voltage should increase to 1.4 to 1.6 volts.

Pin 3 controls the delay circuit, which allows the klystron filament to warm up before the application of the high voltage. During the first minute, the voltage at the pin will be approximately 800 millivolts. It will drop to 0 volts when the high voltage is activated. This is indicated when an RF signal is generated. The delay circuit may be overridden if pin 3 is shorted to ground. The RF signal will slowly build up as the filament is heated.

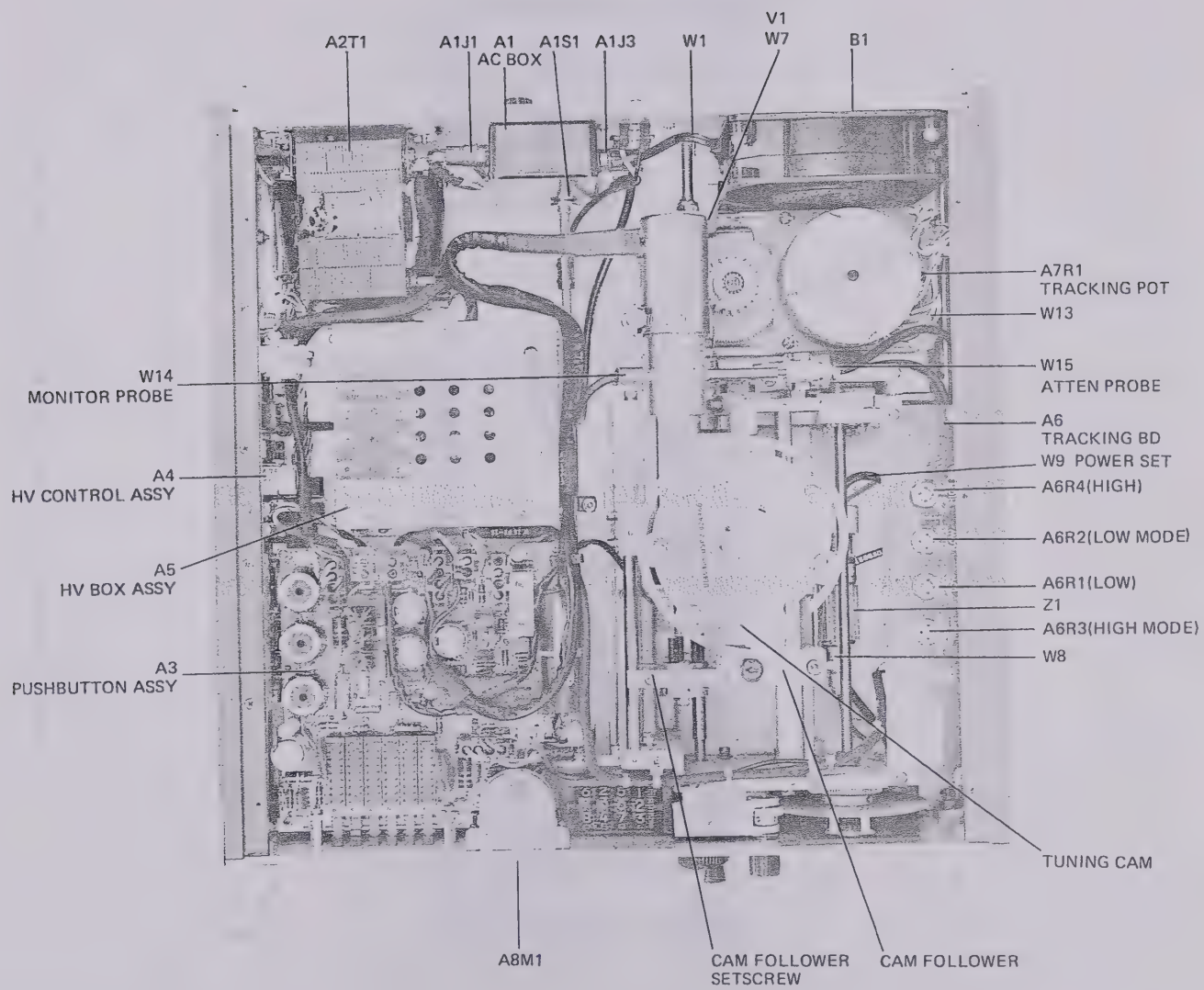


Figure 4-8. Typical Chassis, Top View

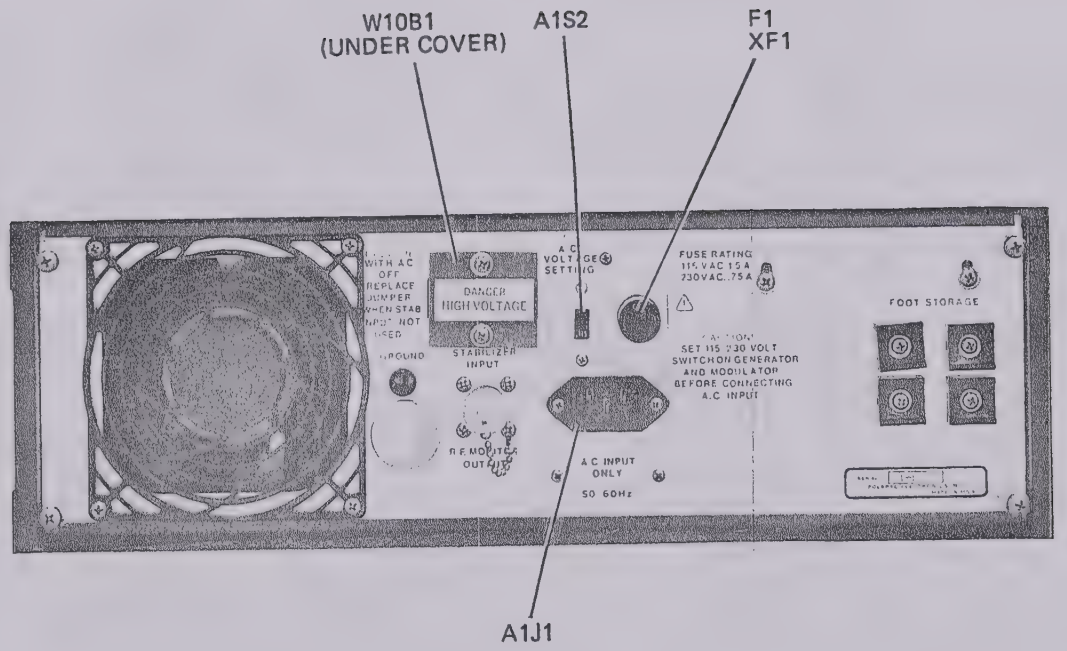


Figure 4-9. Models 1107E, 1108E, 1207E, and 1208E, Rear View

Figure 4-10. Models 1107E, 1108E, 1207E, 1208E Chassis Side View

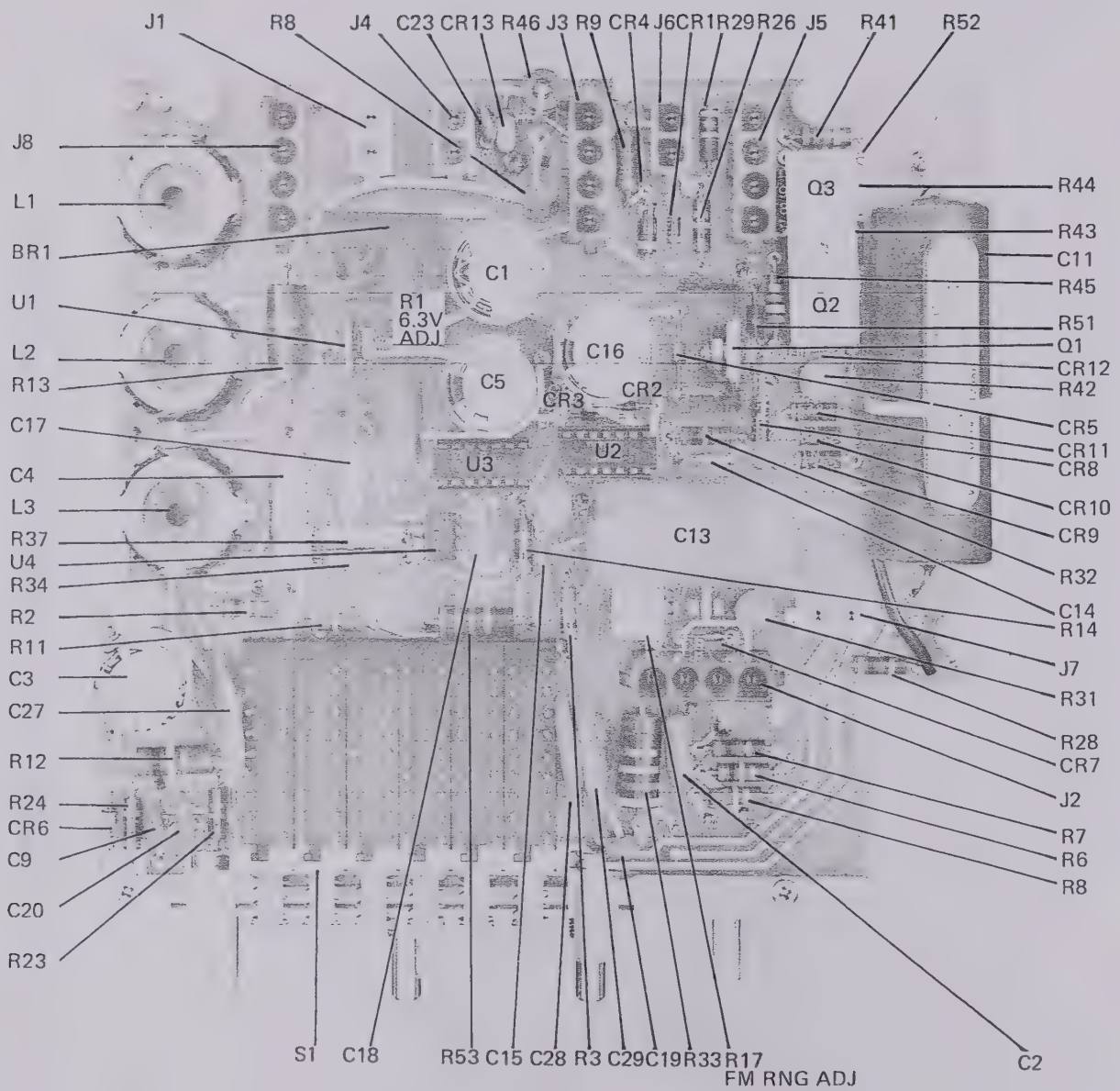
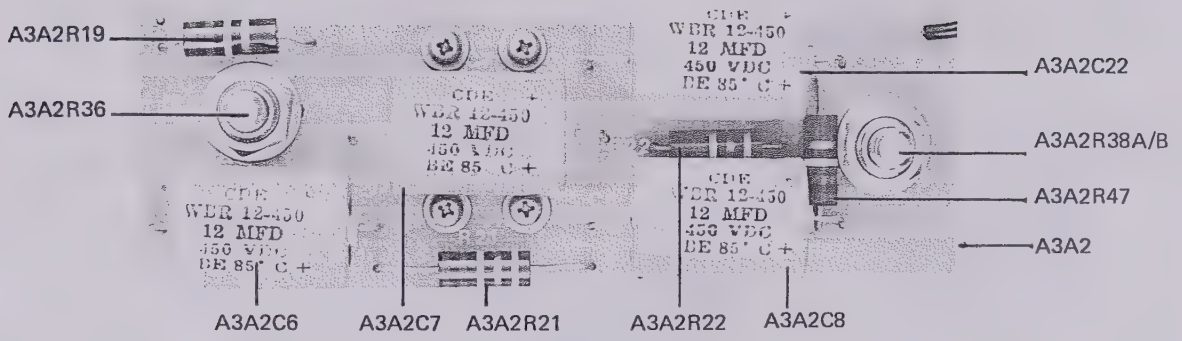


Figure 4-11. Pushbutton Board Assembly A3, Component Layout



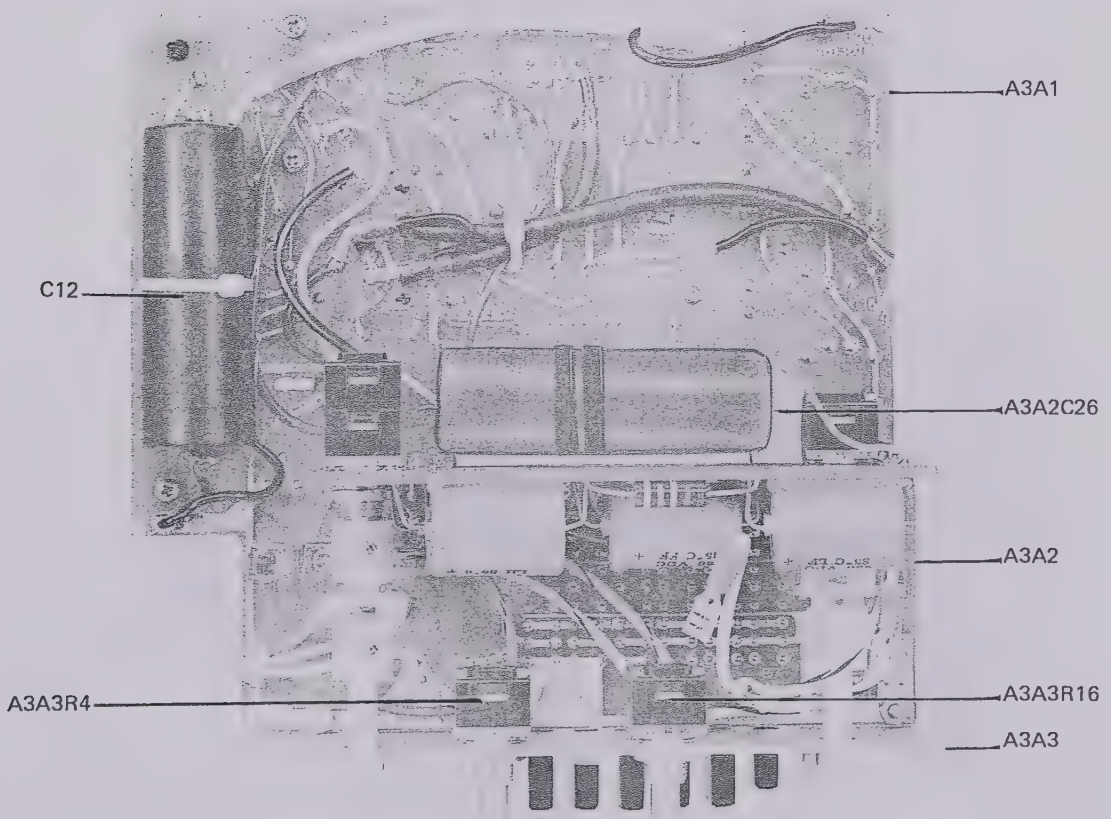
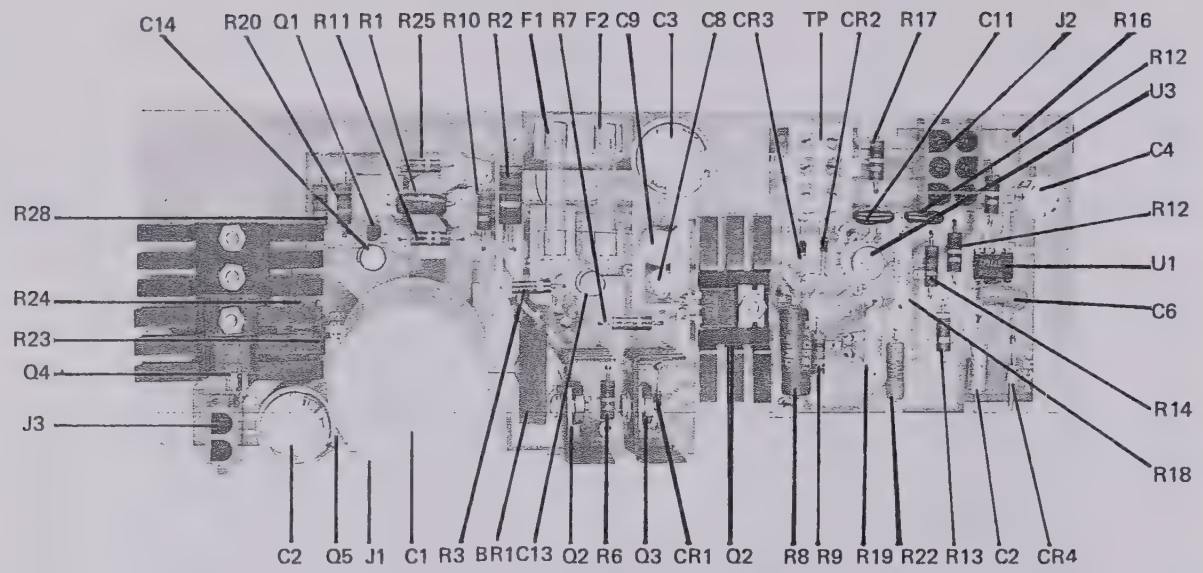


Figure 4-11. Pushbutton Board Assembly A3, Component Layout (Sheet 2)



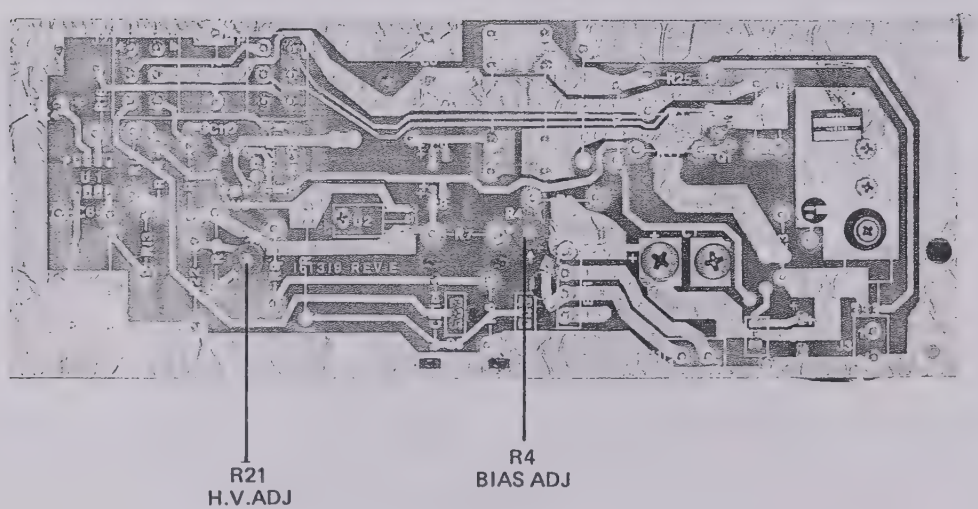


Figure 4-12. High Voltage Control Board Assembly A4, Component Layout

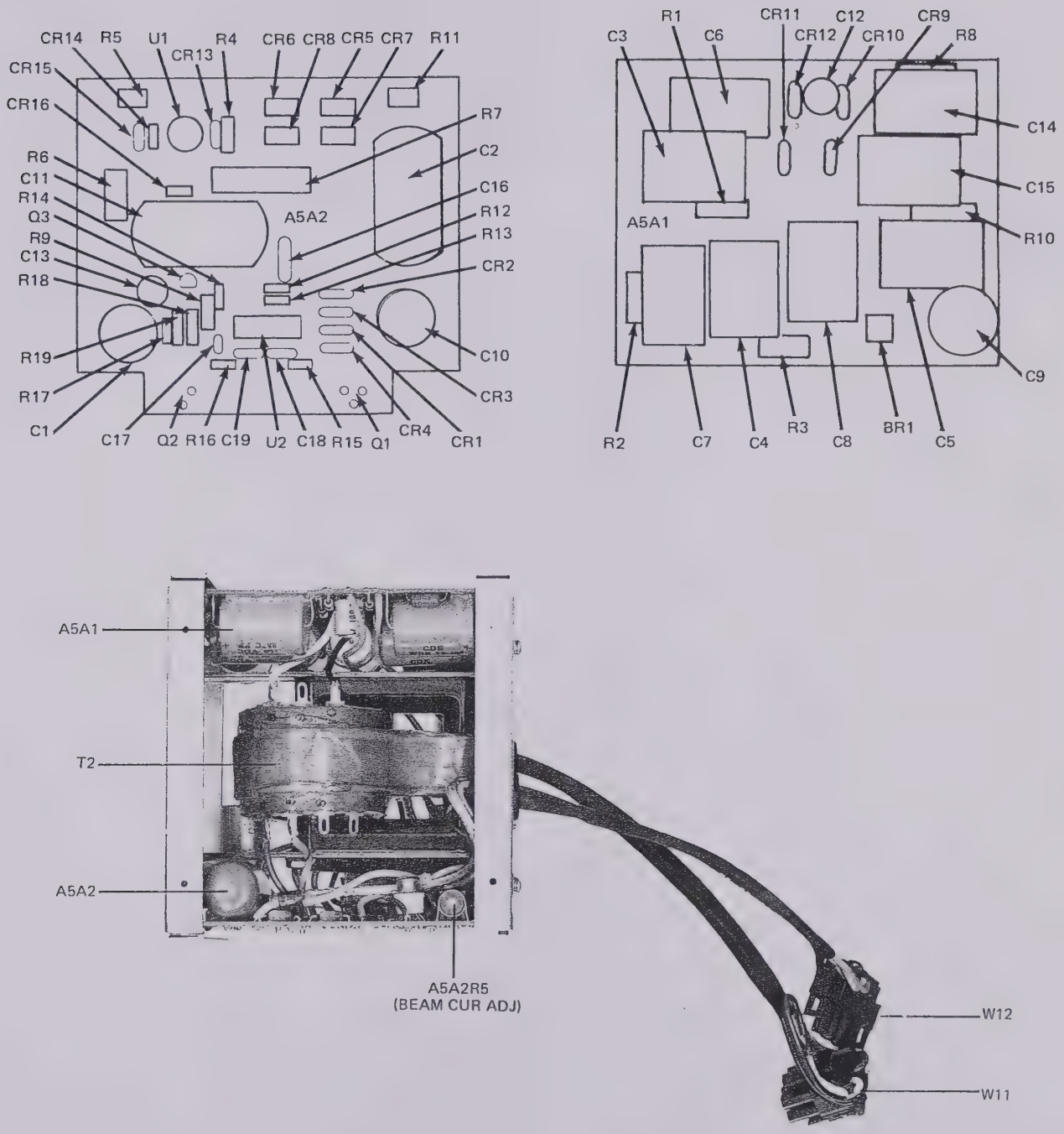


Figure 4-13. High Voltage Box Assembly A5, Component Layout

SECTION V

SCHEMATIC DIAGRAMS

5-1. GENERAL

5-2. This section contains the schematic diagrams (figures 5-1 through 5-7) and voltage and resistance measurements (table 5-1) that are essential aids in the maintenance of Models 1107E, 1108E, 1207E, and 1208E. The diagrams are to be employed in conjunction with Section III to help the technician understand the operation of the units. Both the diagrams and the voltage measurements are to be used in conjunction with Section IV to facilitate troubleshooting and maintenance operations.

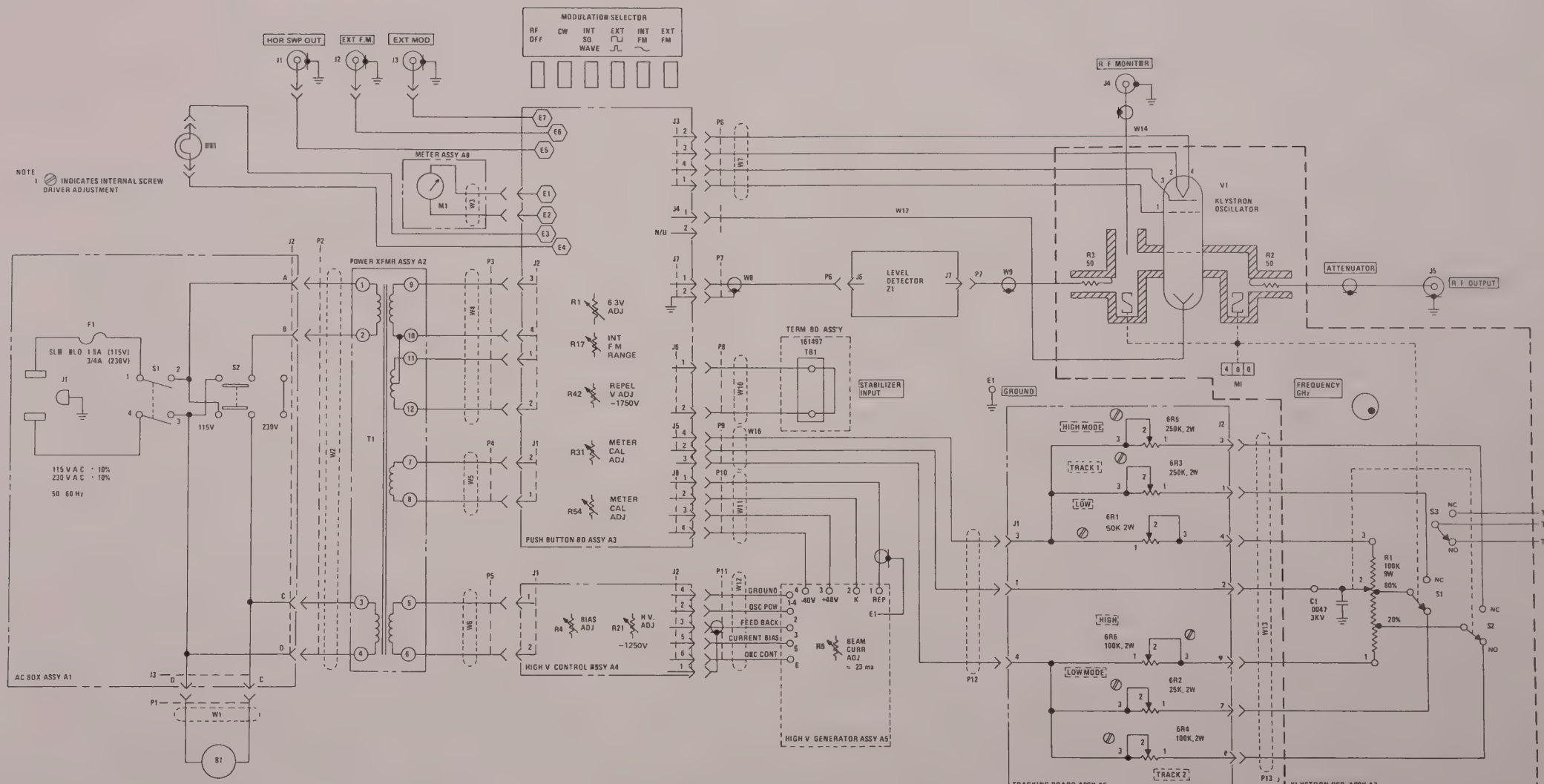


Figure 5-1. Model 1107E Modular Microwave Signal Generator, Schematic Diagram

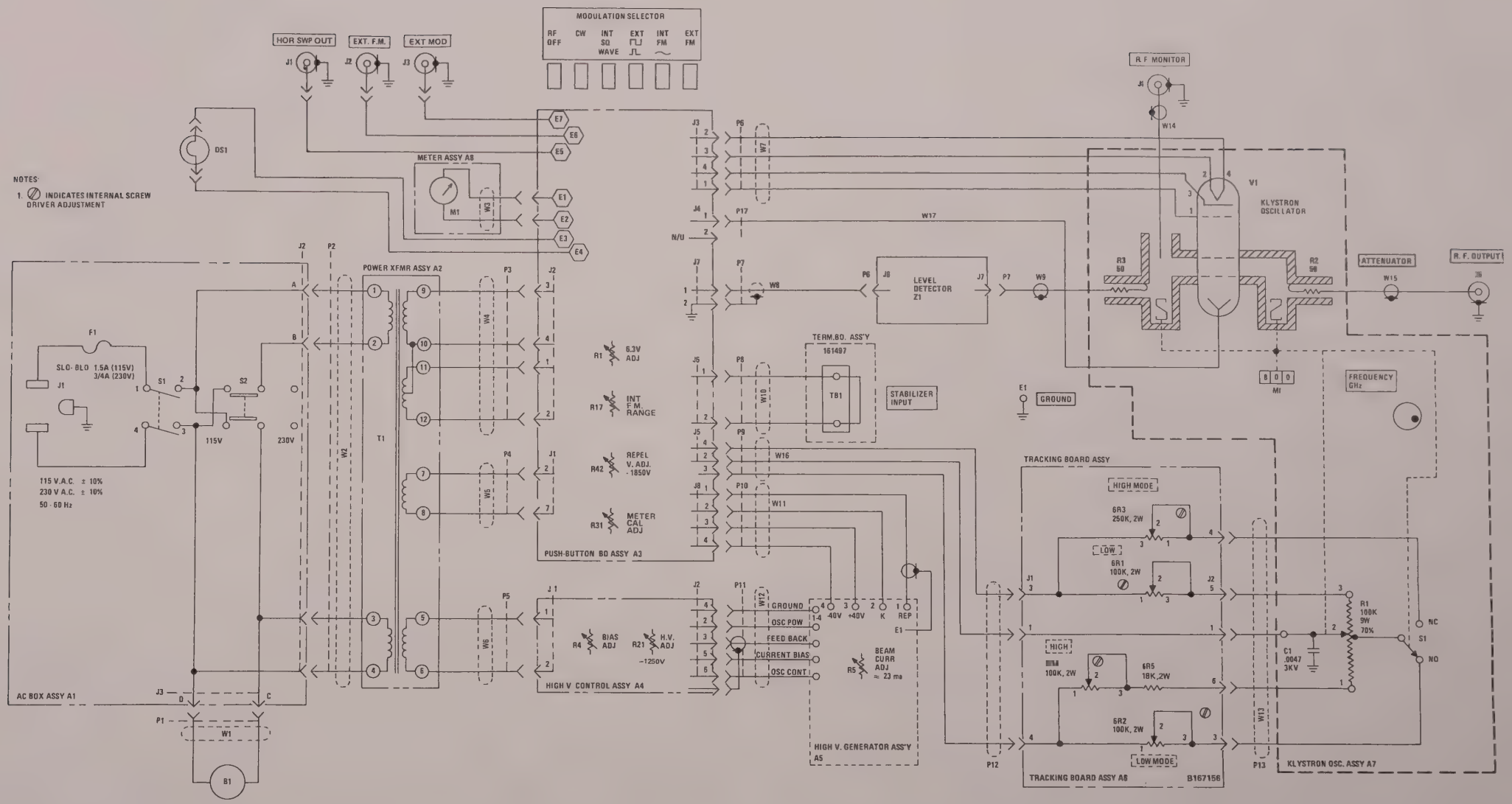


Figure 5-2. Model 1108E Modular Microwave Signal Generator, Schematic Diagram

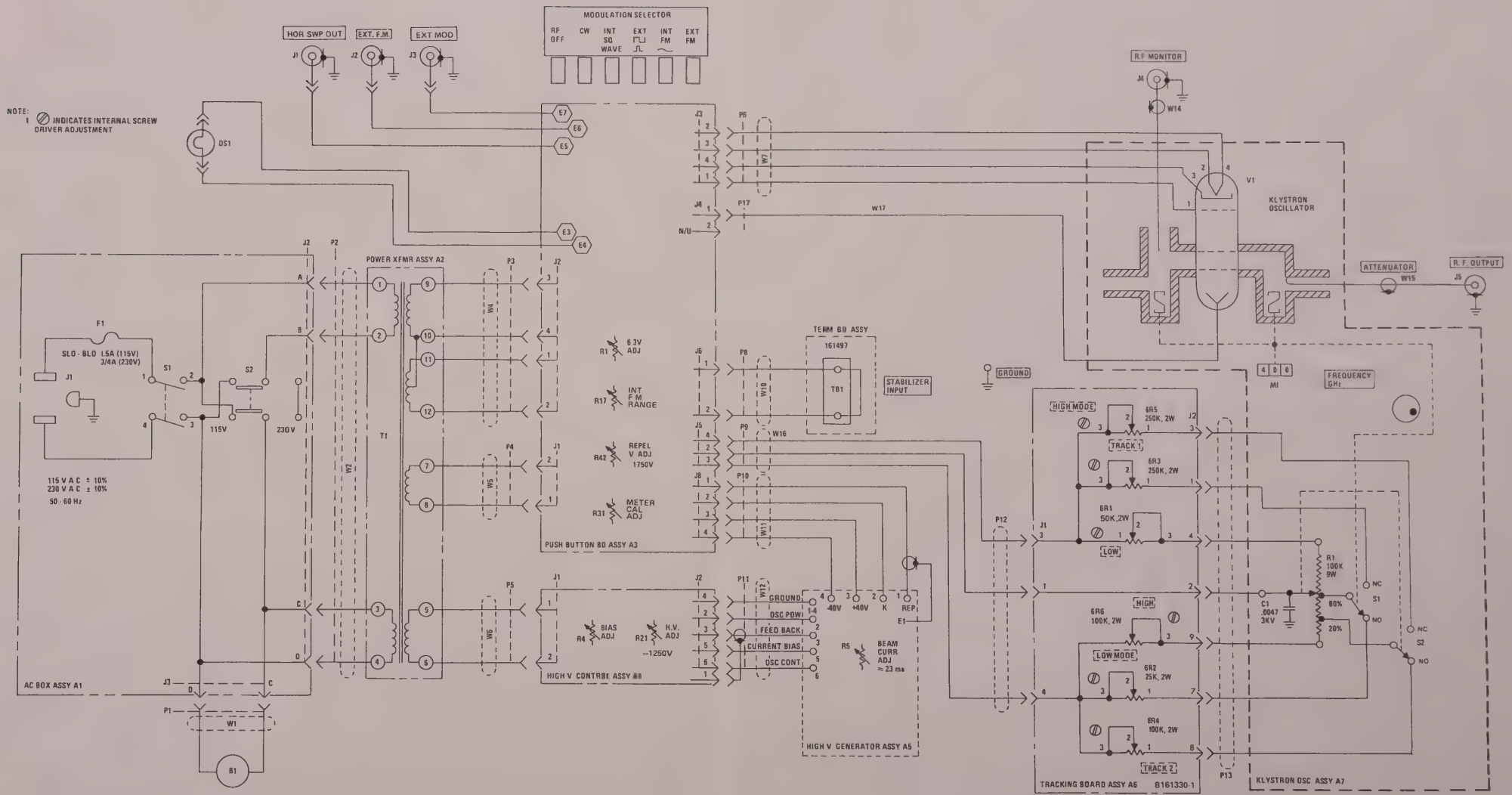


Figure 5-3. Model 1207E, Modular Microwave Signal Source, Schematic Diagram

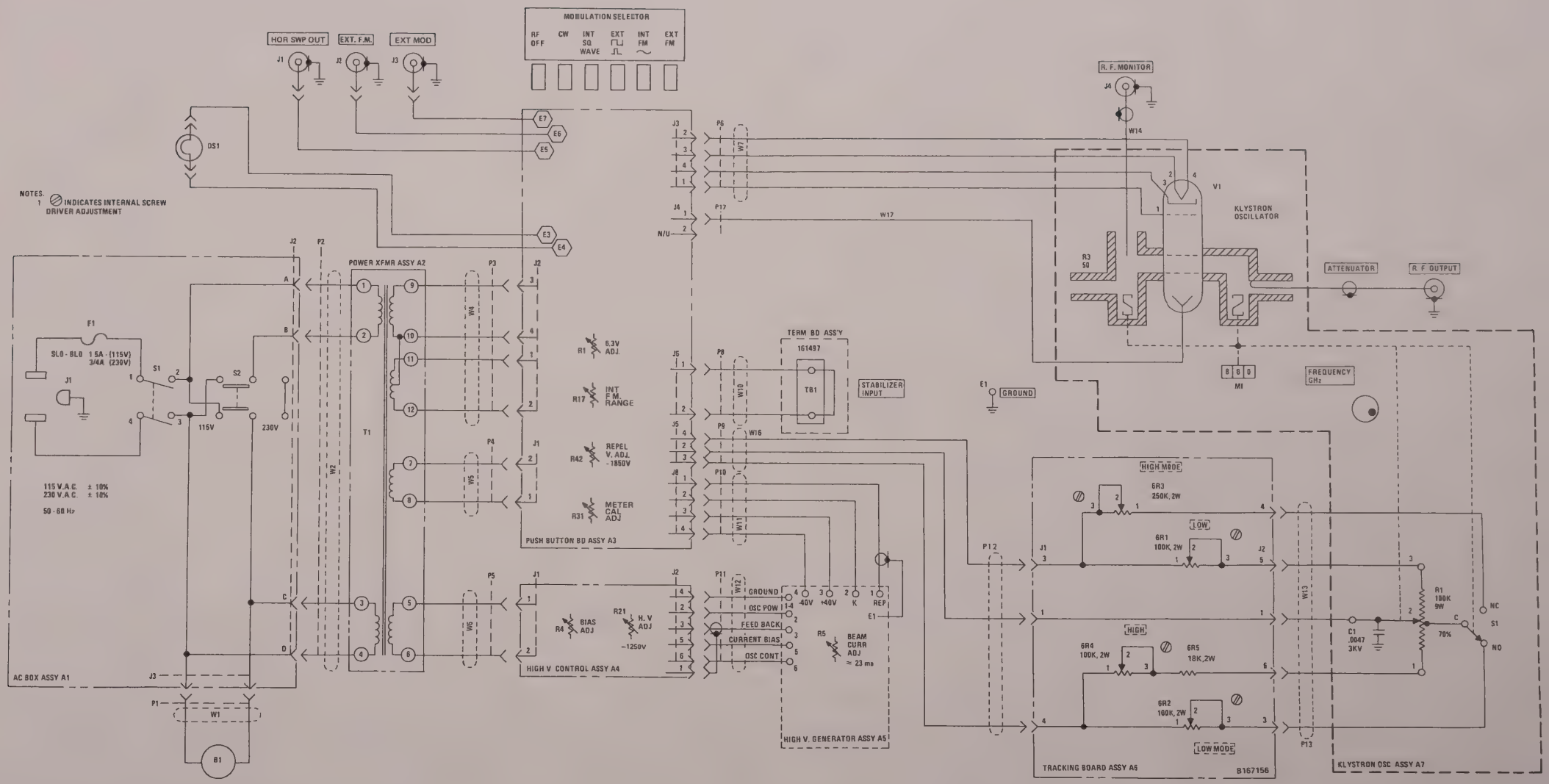


Figure 5-4. Model 1208E, Modular Microwave Signal Source, Schematic Diagram

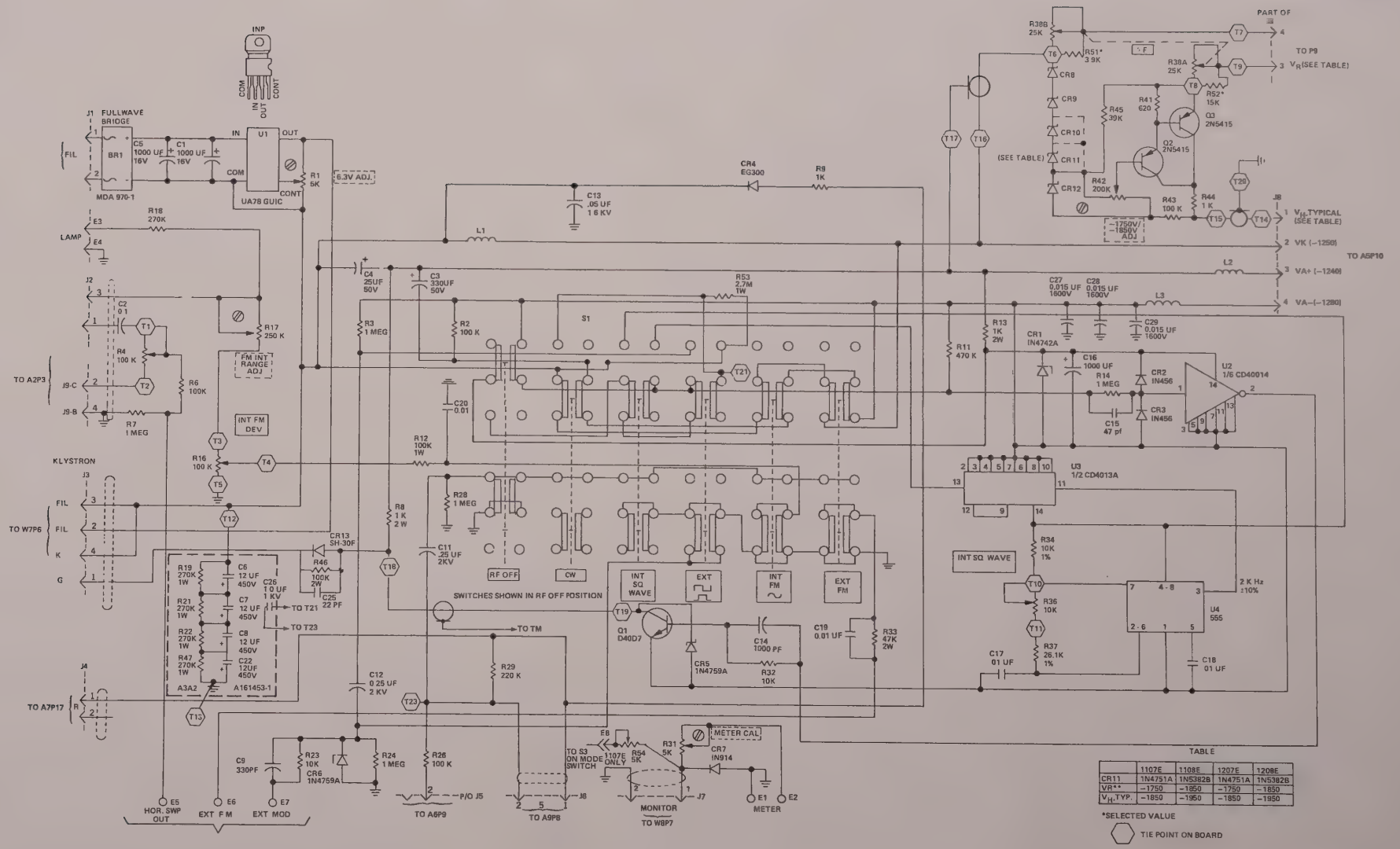


Figure 5-5. Pushbutton Board Assembly A3, Schematic Diagram

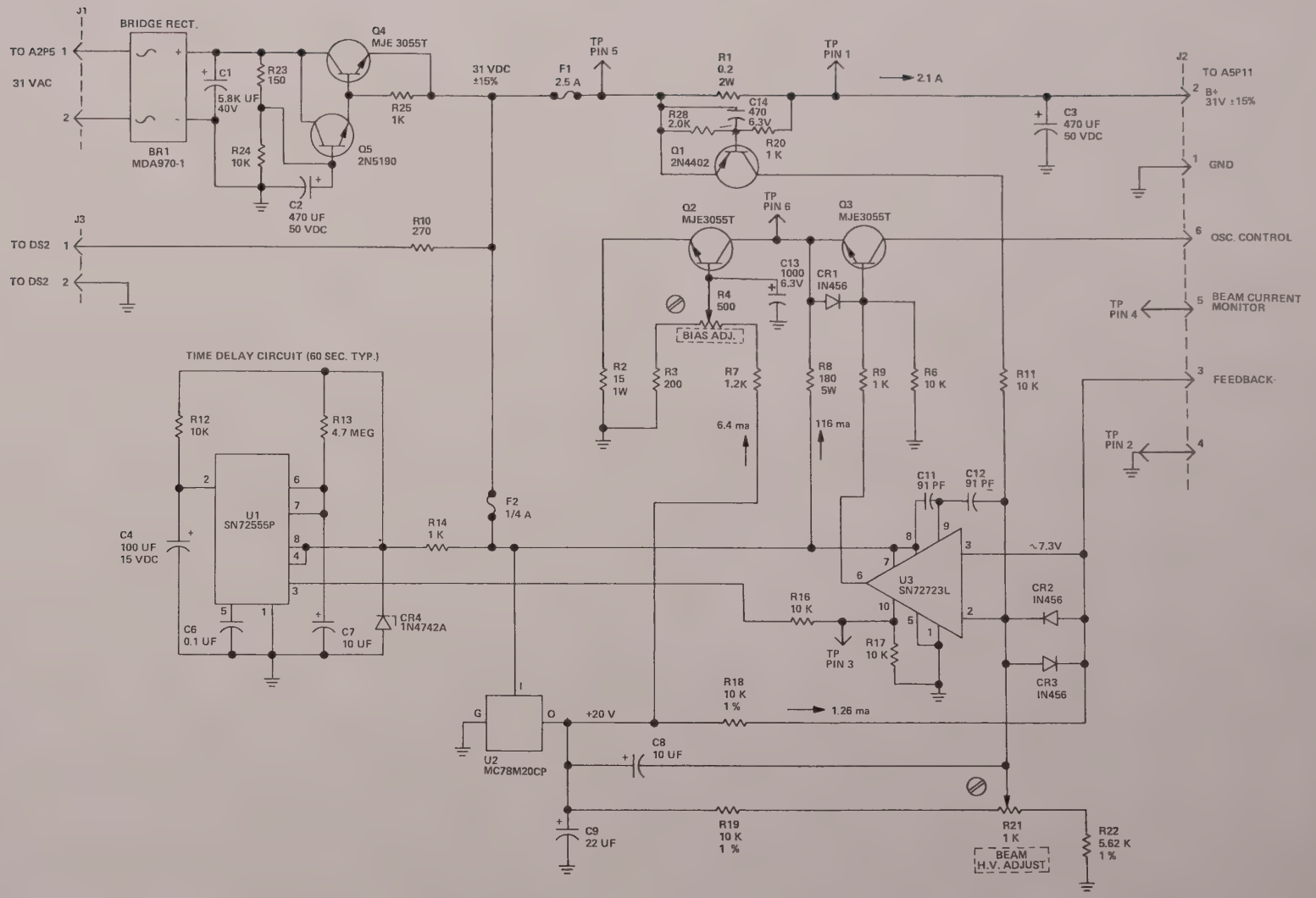
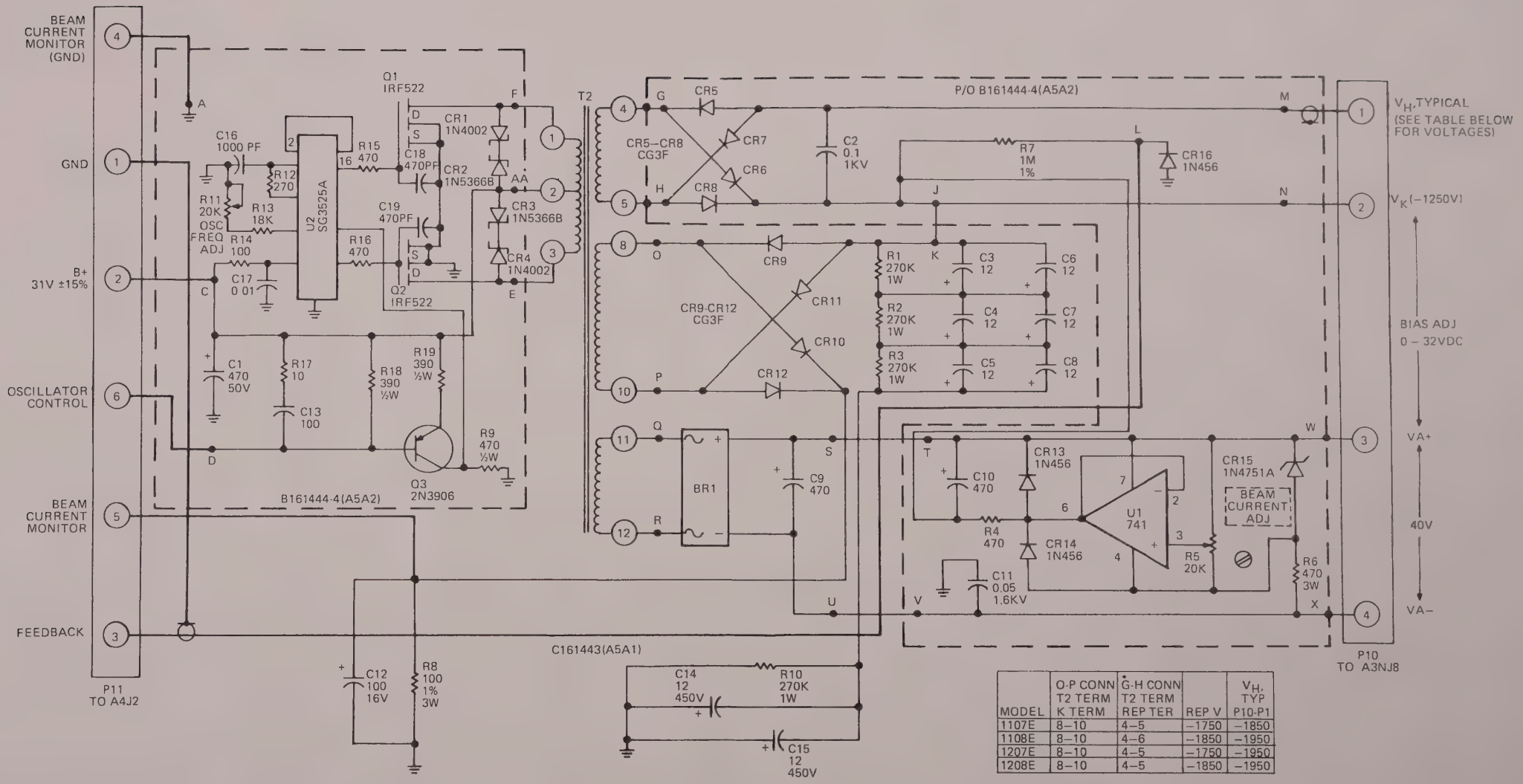


Figure 5-6. High Voltage Board Assembly A4, Schematic Diagram



MODEL	O-P CONN T2 TERM K TERM	G-H CONN T2 TERM REP TER	REP V	V_H, TYP P10-P1
1107E	8–10	4–5	–1750	–1850
1108E	8–10	4–6	–1850	–1950
1207E	8–10	4–5	–1750	–1950
1208E	8–10	4–5	–1850	–1950

Figure 5-7. High Voltage Box Assembly A5, Schematic Diagram

TABLE 5-1. VOLTAGE AND RESISTANCE MEASUREMENTS

SYMBOL	PART NO.	PIN NUMBERS 1 (E)	2 (B)	3 (C)	4	5	6	7	8	9	10	11	12	13	14	UNITS
PUSHBUTTON BOARD ASSEMBLY																
A3A1Q1	D40D7	0	0	+40												Volts
A3A1U2	CD40014P	3K	3.5K	0	3.5K	0	3.5K	0	3.5K	0	3.5K	0	3.5K	0	2K	Ohms
A3A1U3	CD4013AE	3.5K	0	0	0	0	0	0	0	3K	0	2.5K	3K	3K	2K	Ohms
A3A1U4	SN7255P	0	3K	2K	2K	5K	3K	2.5K	2K							Ohms
MODEL 1108E/1208E ONLY																
A3A1J3	350430-1	+11[a]	+6	0	0											Volts
A3A1J4	350786-1	-378[b]	N.C	–	–											Volts
A3A1J5	350792-1	N.C.	-209[b]	-578[b]	-16[b]											Volts
A3A1J6	350786-1	-378[b]	-378[b]	–	–											Volts
A3A1J8	350792-1	-770[b]	0	+17[a]	-24[a]											Volts
MODEL 1107E/1207E ONLY																
A3A1J3	350430-1	+9[a,b]	+6	0	0											Volts
A3A1J4	350786-1	-360[b]	N.C	–	–											Volts
A3A1J5	350792-1	N.C.	-365[b]	-478[b]	-17[b]											Volts
A3A1J6	350786-1	-360[a,b]	-360[a,b]	–	–											Volts
A3A1J8	350792-1	-648[a]	0	+17[a]	-23[a]											Volts

Note: a. Varies from klystron to klystron.
b. Varies from klystron to klystron with frequency.
c. Measurements taken at 7.00 GHz.
d. Connect Fluke Model 8000A Differential Voltmeter Common Lead to Pin 2 of A3A1J8

TABLE 5-1. VOLTAGE AND RESISTANCE MEASUREMENTS (Cont'd)

SYMBOL	IC/TRANS	PIN NUMBERS 1 (E)	2 (B)	3 (C)	4	5	6	7	8	9	10	11	12	13	14	
HIGH VOLTAGE CONTROL BOARD ASSEMBLY																
A4BR1	MDA970-1	25(+)	0(–)													Ohms
		+32.3	0													Volts
A4Q1	2N4402	0.3K	1.2K	15K												Ohms
		+30.1	+29.9	+7.4												Volts
A4Q2	MJE3055T	15	200	45												Ohms
		+2.0	+2.6	+10.1												Volts
A4Q3	MJE3055T	45	250	35												Ohms
		+10.0	+10.6	+32.0												Volts
A4Q4	MJE3055T	0.3K	1.3K	1K												Ohms
		+30.4	+31.2	+32.3												Volts
A4Q5	2N5190	600	450	100												Ohms
		+31.2	+31.8	+32.3												Volts
A4U1	SN7255P	0	15	8	7	3.5K	2.5K	2.5K	7							Ohms
		0	+11.7	0	+11.7	+7.8	0	0	+11.7							Volts
A4U2	MC78M20	12(I)	1.5K(O	0(G)												Ohms
		+29.8	+19.9	0												Volts
A4U3	SN72723L	0	4K	3K	3.5K	0	3K	0.3K	0.3K	3.5K	7K					Ohms
		0	+7.4	+7.4	+7.4	0	+11.6	+29.8	+29.8	+12.6	0					Volts

Note:
1. Measurements taken with Fluke Model 8000A Diiferential Voltmeter and Triplett Model 630A Voltmeter
2. – COMMON lead attached to chassis GND
3. MODULATION SELECTOR switch in CW position

TABLE 5-1. VOLTAGE AND RESISTANCE MEASUREMENTS (Cont'd)

SYMBOL	IC/TRANS	PIN NUMBERS																
		1 (E)	2 (B)	3 (C)	4	5	6	7	8	9	10	11	12	13	14	15	16	
HIGH VOLTAGE BOX ASSEMBLY																		
A5Q1	IRF522	0	3.5K	4.4														Ohms
		0.03	2.45	28.5														Volts
A5Q2	IRF522	0	3.5K	4.4														Ohms
		0.03	2.37	28.5														Volts
A5A2Q3	2N3906	550	390	13														Ohms
		24.0	23.4	5.54														Volts
A5A2U1	SN7241L	2.2K[4]	3.9K[4]	7.9K[4]	470[4]	2.2K[4]	3.9K[4]	3.4K[4]	0[4]									Ohms
		DO NO ATTEMPT VOLTAGE MEASUREMENTS AS HIGH VOLTAGES ARE PRESENT																
A5A2U2	SG3525A		66		500	120	94	70	62	135	0	56	0	54	56	55	66	Ohms
		0	5.1	0.03	0.25	2.18	3.90	2.12	4.80	5.65	0.03	2.34	0.03	5.50	2.42	28.0	5.1	Volts

Notes:

1. Measurements taken with Fluke Model 8000A Differential Voltmeter and Triplett Model 630A Voltmeter.
2. – Common lead attached to chassis GND.
3. MODULATION SELECTOR switch in CW position.
4. Common lead attached to VA– (P10, Pin 4).

SECTION VI

PARTS LIST

6-1. INTRODUCTION

6-2. This parts list provides an alpha-numerical listing in reference symbol sequence of the replaceable electrical, certain electro-mechanical, and mechanical parts of the unit.

6-3. ORDERING INFORMATION. Orders for parts should contain the following information:

a. Equipment name and model number.
b. Serial number.
c. Reference symbol of part, if applicable.
d. Manufacturer's part number and code.

6-4. HOW TO USE THE PARTS LIST

6-5. An explanation of the structure of the parts list,Table 6-2, and the meaning of the entries in the five columns are given in the following paragraphs. (See Figure 6-1.)

6-6. REFERENCE SYMBOL COLUMN. The reference symbol column (1,Figure 6-1) contains the reference symbol number assigned to each part, which also identifies the part on the schematic diagram or illustration. The listing is in alpha-numerical order.

6-7. DESCRIPTION COLUMN. The description column (2) contains a brief description of each part.

6-8. MANUFACTURER'S PART NUMBER COLUMN. The manufacturer's part number column (3) contains the part number assigned by the manufacturer of the part.

6-9. MANUFACTURER'S CODE COLUMN. The manufacturer's code column (4) contains a five digit code identifying the manufacturer of the part. Table 6-1 contains a listing of the five digit codes and the manufacturer's names and addresses.

6-10. QUANTITY COLUMN. The quantity column (5) indicates the quantity of each part contained in the respective assembly or subassembly of the instrument.

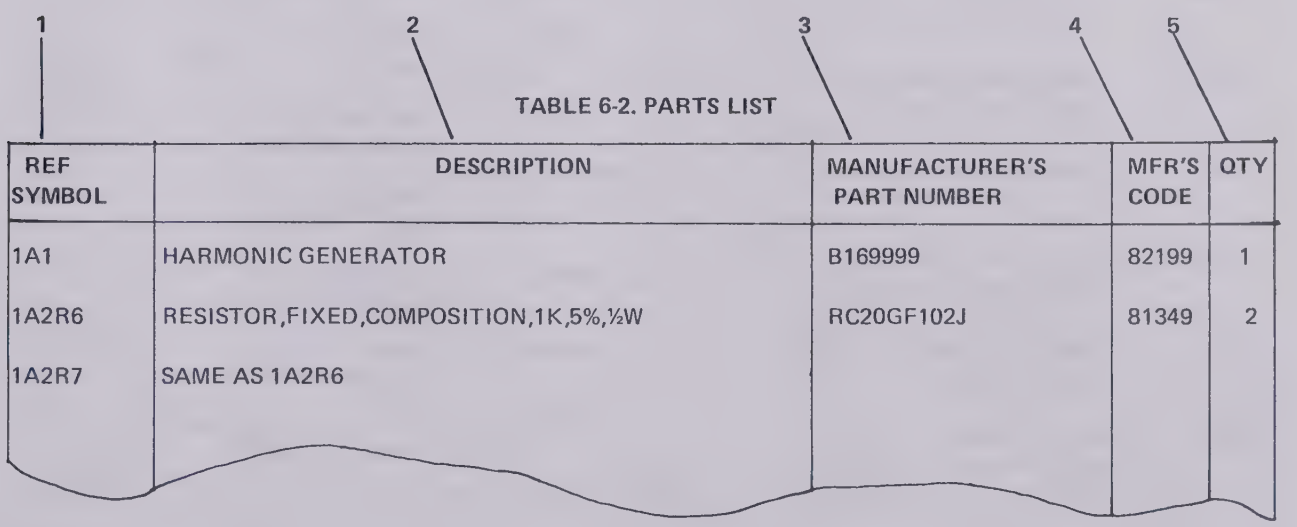


Figure 6-1. Parts List Example

TABLE 6-1. MANUFACTURER'S CODE

Code	Name and Address
00779	AMP Inc. Harrisburg, Pa. 17105
01121	Allen Bradley Co. Milwaukee, Wisc 53204
01295	Texas Instrument Inc. Semiconductor and Components Div. Dallas, Texas 75231
04713	Motorola Semiconductor Products,Inc. Phoenix, Ariz 85008
09214	General Electric Co. Semi-Conductor Products Dept. Auburn, N.Y. 31022
12697	Clarostat Mfg. Co. Dover, N.H. 03820
13715	Fairchild Camera & Instrument Corp. Semiconductor Div. San Rafael, Calif. 94902
14099	Semtech Corp. Newbury Park, Calif. 91320
14655	Cornell-Dubilier Electric Co. Newark, N.J. 07105
16727	Condensor Products Corp. Brooksville, Fla. 33512
37942	P.R.Mallory and Co. Indianaplolis, Ind. 46206
44655	Ohmite Mfg. Co. Skokie, Ill. 60076
56289	Sprague Electric Co. North Adams, Mass. 01247
63472	Ward Leonard Electric Co. Mt. Vernon, N.Y. 10550
71590	Centralab Div. Globe Union, Inc. Milwaukee, Wis. 53201
72982	Erie Technological Products,Inc. Erie, Pa. 16512
73138	Beckman Instruments, Inc. Helipot Div. Fullerton, Calif. 92634
73445	Amperex Electronic Corp. Hicksville, N.Y. 11801
75042	IRC Div. of TRW Inc. Philadelphia, Pa. 19108
75915	Littelfuse Inc. Des Plaines, Ill. 60016
81312	Winchester Electronics Div. Oakville, Conn.
81349	Military Specifications
82199	Polarad Electronics Corp. Lake Success,N.Y. 11040
82389	Switchcraft, Inc. Chicago, Ill. 60630
84411	TRW Capacitor Div. Oglalla, Nebr. 69153
92702	IMC Magnetics Corp. Westbury, N.Y. 11591
95263	Leecraft Mfg. Co., Inc. Long Island City, N.Y. 11101
99999	H. V. Components Assoc. Howell, N.J. 07731

TABLE 6-2 PARTS LIST

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	QTY
	MODELS 1107E AND 1108E SIGNAL GENERATORS MODELS 1207E AND 1208E SIGNAL SOURCES			
A1	**AC BOX ASSEMBLY**	**C161442**	**82199**	**1**
A1F1	FUSE, CARTRIDGE	31301.5	75915	1
A1J1	CONNECTOR, RECEPTACLE	EAC-301	82389	1
A1J2	CONNECTOR, RECEPTACLE	M4S-LRN	81312	2
A1J3	SAME AS A1J2			
A1S1	SWITCH, ROTARY	20BE	71590	1
A1S2	SWITCH, SLIDE	46206LF-1	82389	1
A1XF1	FUSEHOLDER	342004	75915	1
A2	**POWER TRANSFORMER ASSEMBLY**	**C161454**	**82199**	**1**
A2P2	CONNECTOR,PLUG	M4P-LSH10	81312	1
A2P3	CONNECTOR,PLUG	C162119-1	82199	1
A2P4	CONNECTOR,PLUG	C162119-2	82199	2
A2P5	SAME AS A2P4			
A2T1	TRANSFORMER,POWER	C161312	82199	1
A3	**PUSHBUTTON BOARD ASSY(1108E,1208E)**	**D161606-2**	**82199**	**1**
A3	**PUSHBUTTON BOARD ASSY(1107E,1207E)**	**D161606-3**	**82199**	**1**
A3A1	**PUSHBUTTON BD COMP ASSY(1108E,1208E)**	**B161608-1**	**82199**	**1**
A3A1	**PUSHBUTTON BD COMP ASSY(1107E,1207E)**	**B161608-2**	**82199**	**1**
A3A1BR1	RECTIFIER, BRIDGE	MDA970-1	04713	1
A3A1C1	CAPACITOR, ELECTROLYTIC, 1000 UUF, 16VDCW	503D-108G016ER	56289	3
A3A1C2	CAPACITOR, MYLAR, 0.1 UF, 10%, 100 VDCW	PMG1000-2A	73445	1
A3A1C3	CAPACITOR, ELECTROLYTIC, 330 UF, 50 VDCW	VTT330UF	37942	1
A3A1C4	CAPACITOR, ELECTROLYTIC,25 UF, 50 VDCW	30D256G0.50CC0	56289	1
A3A1C5	SAME AS A3A1C1			
A3A1C6 THRU A3A1C8	NOT USED			
A3A1C9	CAPACITOR, CERAMIC,330 UUF,100 VDCW	DD-331	14655	1
A3A1C10	NOT USED			
A3A1C11	CAPACITOR, PAPER, 0.25 UF, 2K VDCW	B161743	82199	2
A3A1C12	SAME AS A3A1C11			
A3A1C13	CAPACITOR, MYLAR, 0.05 UF, 1600 VDCW	16PS-S50	56289	1
A3A1C14	CAPACITOR, CERAMIC, 0.001 UF, 100 VDCW	DD-102	14655	1
A3A1C15	CAPACITOR, CERAMIC, 47 UUF	DD-470	14655	1
A3A1C16	SAME AS A3A1C1			
A3A1C17	CAPACITOR, MYLAR,0.01 UF, 1%, 100 VDCW	663-UW,1%	84411	1
A3A1C18	CAPACITOR, FILM, 0.1 UF	PMG1001-A	73445	1
A3A1C19	CAPACITOR, CERAMIC, 270 UUF	DD271	14665	1
A3A1C20	CAPACITOR, CERAMIC, 0.01 UF, 600 VDCW	811-000-2540-103M	72982	1
A3A1C21 THRU A3A1C24	NOT USED			
A3A1C25	CAPACITOR, CERAMIC, 22 PF	DD30-220	14655	1
A3A1C26	NOT USED			
A3A1C27	CAPACITOR, CERAMIC, 0.015 UF, +80%, -20% 1600 VDCW	DD16-153	14655	3
A3A1C28	SAME AS A3A1C27			

TABLE 6-2 PARTS LIST

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	QTY
A3A1C29	SAME AS A3A1C27			
A3A1CR1	SEMICONDUCTOR DEVICE, DIODE	1N4742A	81349	1
A3A1CR2	SEMICONDUCTOR DEVICE, DIODE	1N456	81349	2
A3A1CR3	SAME AS A3A1CR2			
A3A1CR4	SEMICONDUCTOR DEVICE, DIODE	CG3F	99999	1
A3A1CR5	SEMICONDUCTOR DEVICE, DIODE	1N4759A	81349	2
A3A1CR6	SAME AS A3A1CR5			
A3A1CR7	SEMICONDUCTOR DEVICE, DIODE	1N914	81349	1
A3A1CR8	SEMICONDUCTOR DEVICE, DIODE	1N5382B	81349	3
A3A1CR9	SAME AS A3A1CR8			
A3A1CR10	SAME AS A3A1CR8			
A3A1CR11	SEMICONDUCTOR DEVICE, DIODE (1107E, 1207E)	1N4751A	81349	1
A3A1CR11	SEMICONDUCTOR DEVICE, DIODE (1108E, 1208E)	1N5382B	81349	1
A3A1CR12	SEMICONDUCTOR DEVICE, DIODE	1N4762A	81349	1
A3A1CR13	SEMICONDUCTOR DEVICE, DIODE	SH30F	14099	1
A3A1J1	CONNECTOR, RECEPTACLE	C162191-1	82199	1
A3A1J2	CONNECTOR, RECEPTACLE	C162191-2	82199	1
A3A1J3	CONNECTOR, RECEPTACLE	C162191-12	82199	1
A3A1J4	CONNECTOR, RECEPTACLE	C162191-6	82199	1
A3A1J5	CONNECTOR, RECEPTACLE	C162191-9	82199	1
A3A1J6	CONNECTOR, RECEPTACLE	C162191-7	82199	1
A3A1J7	CONNECTOR, RECEPTACLE	C162191-8	82199	1
A3A1J8	CONNECTOR, RECEPTACLE	C162191-4	82199	1
A3A1L1	CHOKE	A161462	82199	3
A3A1L2, L3	SAME AS A3A1L1			
A3A1Q1	TRANSISTOR	D40D7	09214	1
A3A1Q2	TRANSISTOR	2N5415	81349	2
A3A1Q3	SAME AS A3A1Q2			
A3A1R1	RESISTOR,VARIABLE, 5K	72P5KOHM	73138	1
A3A1R2	RESISTOR,COMPOSITION, 100K,5%,½W	RC20GF104J	81349	4
A3A1R3	RESISTOR,COMPOSITION, 1 MEG,5%,½W	RC20GF105J	81349	5
A3A1R4	NOT USED			
A3A1R5	NOT USED			
A3A1R6	SAME AS A3A1R2			
A3A1R7	SAME AS A3A1R3			
A3A1R8	RESISTOR,COMPOSITION, 1K, 5%, 2W	RC42GF102J	81349	3
A3A1R9	RESISTOR, WIREWOUND, 1K, 5%, 3W	23J1K0	44655	1
A3A1R10	NOT USED			
A3A1R11	RESISTOR,COMPOSITION, 470K, 5%, ½W	RC20GF474J	81349	1
A3A1R12	RESISTOR,COMPOSITION, 100K, 5%, 1W	RC32GF104J	81349	1
A3A1R13	SAME AS 1A3A1R8			
A3A1R14	SAME AS A3A1R3			
A3A1R15	NOT USED			
A3A1R16	NOT USED			
A3A1R17	RESISTOR, VARIABLE, 250K	72P254	73138	1
A3A1R18	RESISTOR,COMPOSITION,270K, 5%, ½W	RC20GF274J	81349	1
A3A1R19 THRU A3A1R22	NOT USED			
A3A1R23	RESISTOR,COMPOSITION, 10K, 5%, ½W	RC20GF103J	81349	2
A3A1R24	SAME AS A3A1R3			
A3A1R25	NOT USED			
A3A1R26	SAME AS A3A1R2			

TABLE 6-2. PARTS LIST

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	QTY
A3A1R27	NOT USED			
A3A1R28	SAME AS A3A1R3			
A3A1R29	RESISTOR, COMPOSITION, 220K, 5%, ½W	RC20GF224J	81349	1
A3A1R30	NOT USED			
A3A1R31	RESISTOR, VARIABLE, 5K, 5%, ½W	3339H-1-502	80294	2
A3A1R32	SAME AS A3A1R23			
A3A1R33	RESISTOR, COMPOSITION, 47K, 5%, 2W	RC42GF473J	81349	1
A3A1R34	RESISTOR, FILM, 10K, 1%, ½W	RN65C1002F	81349	1
A3A1R35	NOT USED			
A3A1R36	NOT USED			
A3A1R37	RESISTOR, FILM, 26.1K, 1%, ½W	RN65C2612F	81349	1
A3A1R38 THRU A3A1R40	NOT USED			
A3A1R41	RESISTOR, COMPOSITION, 620 OHMS, 5%, ½W	RC20GF621J	81349	1
A3A1R42	RESISTOR, VARIABLE, 200K, 5%, ½W	3339H-L-204	80294	1
A3A1R43	SAME AS A3A1R2			
A3A1R44	SAME AS A3A1R8			
A3A1R45	RESISTOR, COMPOSITION, 39K, 5%, ½W	RC20GF393J	81349	1
A3A1R46	RESISTOR, COMPOSITION, 100K, 5%, 2W	RC42GF104J	81349	1
A3A1R47 THRU A3A1R50	NOT USED			
A3A1R51	RESISTOR, COMPOSITION, 3.9K, 5%, ½W	RC20GF392J	81349	1
A3A1R52	RESISTOR, COMPOSITION, 15K, 5%, ½W	RC20GF153J	81349	1
A3A1R53	RESISTOR, COMPOSITION, 2.7 MEG, 5%, 1W	RC32GF375J	81349	1
A3A1R54	SAME AS A3A1R31(1107E ONLY)			
A3A1S1	SWITCH, PUSHBUTTON	A161318	82199	1
A3A1U1	INTEGRATED CIRCUIT	UA78-GUIC	13715	1
A3A1U2	INTEGRATED CIRCUIT	40014P	13715	1
A3A1U3	INTEGRATED CIRCUIT	CD4013AE	49671	1
A3A1U4	INTEGRATED CIRCUIT	SN72555P	01295	1
A3A2	**CAPACITOR BOARD**	**B161453-1**	**82199**	**1**
A3A2C1 THRU A3A2C5	NOT USED			
A3A2C6	CAPACITOR, ELECTROLYTIC, 12UF, 450 VDCW	WBR12-1450	14655	4
A3A2C7	SAME AS A3A2C6			
A3A2C8	SAME AS A3A2C6			
A3A2C9 THRU A3A2C21	NOT USED			
A3A2C22	SAME AS A3A2C6			
A3A2C23 THRU A3A2C25	NOT USED			
A3A2C26	CAPACITOR, MYLAR, 1 UF, 1K VDCW	10PS-P10	56289	1
A3A2R1 THRU A3A2R18	NOT USED			
A3A2R19	RESISTOR, COMPOSITION, 270K, 5%, 1W	RC32GF274J	81349	1
A3A2R20	NOT USED			
A3A2R21	SAME AS A3A2R19			
A3A2R22	SAME AS A3A2R19			

TABLE 6-2. PARTS LIST

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	QTY
A3A2R23 THRU A3A2R35	NOT USED			
A3A2R36	RESISTOR, VARIABLE, 10K, 5%, 2W	70BIN048F103	01121	1
A3A2R37	NOT USED			
A3A2R38	RESISTOR, VARIABLE, 25K, 5%, 2W	70DIN048P253W	01121	1
A3A2R39 THRU A3A2R46	NOT USED			
A3A2R47	SAME AS A3A2R19			
A3A3	**PUSHBUTTON BRACKET ASSEMBLY**	**B161495**	**82199**	**1**
A3A3R4	RESISTOR, VARIABLE, 100K, 5%, ½W	70BIN56P104W	01121	2
A3A3R16	SAME AS A3A3R4			
A4	**HIGH VOLTAGE CONTROL BOARD**	**C161321-1**	**82199**	**1**
A4BR1	BRIDGE RECTIFIER	MDA970-1	04713	1
A4C1	CAPACITOR, ELECTROLYTIC, 5800 UF, 40 VDCW	86F556M1	56289	1
A4C2	CAPACITOR, ELECTROLYTIC, 470 UF, 40 VDCW	503D-477G050ET	56289	2
A4C3	SAME AS A4C2			
A4C4	CAPACITOR, ELECTROLYTIC, 100 UF, 16 VDCW	503D-107G016CD	56289	1
A4C5	NOT USED			
A4C6	CAPACITOR, MYLAR, 0.1 UF	280AE/104	73445	1
A4C7	CAPACITOR, TANTALUM, 10UF, 10%, 25 VDCW	162D106X902DD2	56289	1
A4C8	CAPACITOR, ELECTROLYTIC, 10 UF, 25 VDCW	503D-106G025AB	56289	1
A4C9	CAPACITOR, ELECTROLYTIC, 22 UF, 25 VDCW	503D-226G025AB	56289	1
A4C10	NOT USED			
A4C11	CAPACITOR, MICA, 91 PF, 10%	CM05D910G03	81349	2
A4C12	SAME AS A4C11			
A4C13	CAPACITOR, ELECTROLYTIC, 1000 UF, 6.3 VDCW	503D-108G6R3DK	56289	1
A4C14	CAPACITOR, ELECTROLYTIC, 470 UF, 6.3 VDCW	503D-477G6R3CG	56289	1
A4CR1	SEMICONDUCTOR DEVICE, DIODE	1N456	81349	3
A4CR2	SAME AS A4CR1			
A4CR3	SAME AS A4CR1			
A4CR4	SEMICONDUCTOR DEVICE, DIODE	1N4742A	81349	1
A4F1	FUSE, CARTRIDGE, 2.5 AMP	31202.5	75915	1
A4F2	FUSE, CARTRIDGE, ¼ AMP	312.250	75915	1
A4Q1	TRANSISTOR	2N4402	81349	1
A4Q2	TRANSISTOR	MJE3055T	04713	3
A4Q3	SAME AS A4Q2			
A4Q4	SAME AS A4Q2			
A4Q5	TRANSISTOR	2N5190	81349	1
A4R1	RESISTOR, FILM, 0.2 OHMS, 1%, 2W	AS-1-0.2,1%	75042	1
A4R2	RESISTOR, COMPOSITION, 15 OHMS, 5%, 1W	RC32GF150J	81349	1
A4R3	RESISTOR, COMPOSITION, 200 OHMS, 5%, ½W	RC20GF201J	81349	1
A4R4	RESISTOR, VARIABLE, 500 OHMS	3339H-1-501	80294	1
A4R5	NOT USED			
A4R6	RESISTOR, COMPOSITION, 10K, 5%, ½W	RC20GF103J	81349	4
A4R7	RESISTOR, COMPOSITION, 1.2K, 5%, ½W	RC20GF122J	81349	1
A4R8	RESISTOR, WW, 180 OHMS, 5%, 5W	5XM180	63742	1
A4R9	RESISTOR, COMPOSITION, 1K, 5%, ½W	RC20GF102J	81349	4
A4R10	RESISTOR, COMPOSITION, 270 OHMS, 5%, ½W	RC20GF271J	81349	1
A4R11	SAME AS A4R6			
A4R12	SAME AS A4R6			

TABLE 6-2 PARTS LIST

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	QTY
A4R13	RESISTOR, COMPOSITION, 4.7 MEG, 5%, ½W	RC20GF475J	81349	1
A4R14	SAME AS A4R9			
A4R15	NOT USED			
A4R16	RESISTOR, COMPOSITION, 3.9K, 5%, ½W	RC20GF392J	81349	1
A4R17	RESISTOR, COMPOSITION, 470 OHMS, 5%, ½W	RC20GF471J	81349	1
A4R18	RESISTOR, FILM, 10K, 1%, ½W	RN65C1002F	81349	2
A4R19	SAME AS A4R18			
A4R20	SAME AS A4R9			
A4R21	RESISTOR, VARIABLE, 1K	3339H-1-102	80294	1
A4R22	RESISTOR, FILM, 5.62K, 1%, ½W	RN65C5621F	81349	1
A4R23	RESISTOR, COMPOSITION, 150 OHMS, 5%, ½W	RC20GF151J	81349	1
A4R24	SAME AS A4R6			
A4R25	SAME AS A4R9			
A4R26	NOT USED			
A4R27	NOT USED			
A4R28	RESISTOR, COMPOSITION, 2K, 5%,½W	RC20GF202J	81349	1
A4U1	INTEGRATED CIRCUIT	SN72555P	01295	1
A4U2	INTEGRATED CIRCUIT	MC78M20CP	04713	1
A4U3	INTEGRATED CIRCUIT	SN72723L	01295	1
A5	**HIGH VOLTAGE BOX**	**D161309-4**	**82199**	1
A5A1	**HV GENERATOR COMPONENT ASSY**	**C161443-2**	**82199**	1
A5A1BR1	RECTIFIER, BRIDGE	MDA920A-3	04713	1
A5A1C1	NOT USED			
A5A1C2	NOT USED			
A5A1C3	CAPACITOR, ELECTROLYTIC,12UF,450WVDC	WBR12-450	14655	8
A5A1C4 THRU A5A1C8	SAME AS A5A1C3			
A5A1C9	CAPACITOR, ELECTROLYTIC, 470 UF, 50 VDCW	503D477G0	56289	1
A5A1C10	NOT USED			
A5A1C11	NOT USED			
A5A1C12	CAPACITOR, ELECTROLYTIC, 100UF,16VDCW	503D-107G0	56289	1
A5A1C13	NOT USED			
A5A1C14	SAME AS A5A1C3			
A5A1C15	SAME AS A5A1C3			
A5A1CR1 THRU A5A1CR8	NOT USED			
A5A1CR9	SEMICONDUCTOR DEVICE, DIODE	SH30F	14099	4
A5A1CR10	SAME AS A5A1CR9			
A5A1CR11	SAME AS A5A1CR9			
A5A1CR12	SAME AS A5A1CR9			
A5A1R1	RESISTOR, COMPOSITION, 270K, 5%, 1W	RC32GF274J	81349	4
A5A1R2	SAME AS A5A1R1			
A5A1R3	SAME AS A5A1R1			
A5A1R4 THRU A5A1R7	NOT USED			
A5A1R8	RESISTOR, WW, 100 OHMS, 1%, 3W	300S,100 OHMS	83125	1
A5A1R9	NOT USED			
A5A1R10	SAME AS A5A1R1			

TABLE 6-2. PARTS LIST

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	QTY
A5A2	**MASTER OSCILLATOR COMPONENT ASSY**	**B161444-4**	**82199**	1
A5A2C1	CAPACITOR, ELECTROLYTIC, 470 UUF, 50 WVDC	503D-477F050QG	56289	2
A5A2C2	CAPACITOR, ELECTROLYTIC, 0.1 UF, 1 KV	10PS-P10	56289	1
A5A2C3 THRU A5A2C9	NOT USED			
A5A2C10	SAME AS A5A2C1			
A5A2C11	CAPACITOR, ELECTROLYTIC, 0.05 UF, 1.6 KV	16PS-S50	56289	1
A5A2C12	NOT USED			
A5A2C13	CAPACITOR, ELECTROLYTIC, 100 UF, 25 WVDC	VTL100S25	37942	1
A5A2C14	NOT USED			
A5A2C15	NOT USED			
A5A2C16	CAPACITOR, MICA, 1000 PF, 500 VDCW	CM06FD102J03	81349	1
A5A2C17	CAPACITOR, CERAMIC, 0.01 UF, 100 VDCW	8121-100-651-103M	72982	1
A5A2C18	CAPACITOR, MICA, 470 PF	DM15471J	53021	2
A5A2C19	SAME ASA5A2C18			
A5A2CR1	SEMICONDUCTOR DEVICE, DIODE	1N4002	81349	2
A5A2CR2	SEMICONDUCTOR DEVICE, DIODE	1N5366B	81349	2
A5A2CR3	SAME AS A5A2CR2			
A5A2CR4	SAME AS A5A2CR1			
A5A2CR5	SEMICONDUCTOR DEVICE, DIODE	CG3F	99999	2
A5A2CR6	SAME AS A5A2CR5			
A5A2CR7	SAME AS A5A2CR5			
A5A2CR8	SAME AS A5A2CR5			
A5A2CR9	SAME AS A5A2CR5			
A5A2CR10	SAME AS A5A2CR5			
A5A2CR11	SAME AS A5A2CR5			
A5A2CR12	SAME AS A5A2CR5			
A5A2CR13	SEMICONDUCTOR DEVICE, DIODE	1N456	81349	1
A5A2CR14	SAME AS A5A2CR13			
A5A2CR15	SEMICONDUCTOR DEVICE, DIODE	1N4751A	81349	1
A5A2CR16	SAME AS A5A2CR13			
A5A2Q1	NOT USED			
A5A2Q2	NOT USED			
A5A2Q3	TRANSISTOR	2N3906	81349	1
A5A2R1	NOT USED			
A5A2R2	NOT USED			
A5A2R3	NOT USED			
A5A2R4	RESISTOR, COMPOSITION, 470 OHMS, 5%, ½W	RC20GF471J	81349	2
A5A2R5	RESISTOR, VARIABLE, 20K	3339W-1-203	80294	2
A5A2R6	RESISTOR, WW, 470 OHMS, 5%, 3W	VC3D,470,5%	12697	1
A5A2R7	RESISTOR, FILM, 1 MEG, 1%, 2W	CGH-2, 1 MEG	75042	1
A5A2R8	NOT USED			
A5A2R9	SAME AS A5A2R4			
A5A2R10	NOT USED			
A5A2R11	SAME AS A5A2R5			
A5A2R12	RESISTOR, COMPOSITION, 270 OHMS, 5%, ¼W	RC07GF271J	81349	1
A5A2R13	RESISTOR, COMPOSITION, 18K, 5%, ¼W	RC07GF183J	81349	1
A5A2R14	RESISTOR, COMPOSITION, 100 OHMS, 5%, ¼W	RC07GF101J	81349	1
A5A2R15	RESISTOR, COMPOSITION, 470 OHMS, 5%, ¼W	RC07GF471J	811349	2
A5A2R16	SAME AS A5A2R15			
A5A2R17	RESISTOR, COMPOSITION, 10 OHM, 5%, ¼W	RC07GF100J	81349	1
A5A2R18	RESISTOR, COMPOSITION, 390 OHM, 5%, ¼W	RC07GF391J	81349	2
A5A2R19	SAME AS A5A2R18			

Page 6-8, Table 6-2: Add C20, C21, R20, and R21.

TABLE 6-2. PARTS LIST

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	QTY
A5A2C20	CAPACITOR, MICA, 120 PF, 5%	CM04ED121J	81349	2
A5A2C21	SAME AS A5A2C20			
A5A2R20	RESISTOR, COMPOSITION, 3.9K, 5%, ¼W	RC07GF392J	81349	2
A5A2R21	SAME AS A5A2R20			

TABLE 6-2. PARTS LIST

REF SYMBOL	DESCRIPTION	MANUFACTURER'S PART NUMBER	MFR'S CODE	QTY
A5A2U1	INTEGRATED CIRCUIT	SN72741L	01295	1
A5A2U2	INTEGRATED CIRCUIT	SG3525A	34333	1
A5Q1	TRANSISTOR	IRF522	81483	2
A5Q2	SAME AS A5Q1			
A5T2	TRANSFORMER	C161313	82199	1
A5W11	CABLE ASSEMBLY	B161490	82199	1
A5W12	CABLE ASSEMBLY	B161491	82199	1
A6	**TRACKING BOARD ASSY (1107E, 1207E)**	**B161330-1**	**82199**	**1**
A6J1	CONNECTOR, RECEPTACLE	C162191-10	82199	1
A6J2	CONNECTOR, PLUG	C162191-11	82199	1
A6R1	RESISTOR, VARIABLE, 50K, 5%, 2W	70B5L040S503W	01121	1
A6R2	RESISTOR, VARIABLE, 25K, 5%, 2W	70B5L040S253W	01121	1
A6R3	RESISTOR, VARIABLE, 250K, 5%, 2W	70B5L040S254W	01121	2
A6R4	RESISTOR, VARIABLE, 100K, 5%, 2W	70B5L040S104W	01121	2
A6R5	SAME AS A6R3			
A6R6	SAME AS A6R4			
A6	**TRACKING BOARD ASSY (1108E, 1208E)**	**C167156**	**82199**	**1**
A6J1	CONNECTOR, RECEPTACLE	C162191-10	82199	1
A6J2	CONNECTOR, RECEPTACLE	C162191-5	82199	1
A6R1	RESISTOR, VARIABLE, 100K, 5%, 2W	70B5L040S104W	01121	3
A6R2	SAME AS A6R1			
A6R3	RESISTOR, VARIABLE, 250K, 5%, 2W	70B5L040S254W	01121	1
A6R4	SAME AS A6R1			
A6R5	RESISTOR, COMPOSITION, 18%, 5%, ½W	RC07GF183J	81349	1
A7	**TUNING HEAD ASSY (1107E)**	**E161550**	**82199**	**1**
A7	**TUNING HEAD ASSY (1108E)**	**E161633**	**82199**	**1**
A7	**TUNING HEAD ASSY (1207E)**	**E161716**	**82199**	**1**
A7	**TUNING HEAD ASSY (1208E)**	**E161715**	**82199**	**1**
A7R81	RESISTOR, VARIABLE, 100K, 1%, 9W	B162345-1	82199	1
A7S1	SWITCH, SENSITIVE (1107E, 1108E, 1207E, 1208E)	AN4234-1	81349	1
A7S2	SWITCH, SENSITIVE (1107E, 1108E)	AN4234-1	81349	1
A7S3	SWITCH, SENSITIVE (1107E)	859014	82199	1
A8	**METER ASSY**	**B161311**	**82199**	**1**
A8M1	METER	A710282	82199	1
B1	FAN	WS2107FL	92702	1
C1	CAPACITOR, CERAMIC, 0.0047UF	60GAD47	56289	1
DS1	LAMP	332-1111T	95263	1
J1	CONNECTOR, RECEPTACLE	B161509	82199	3
J2	SAME AS J1			
J3	SAME AS J1			
V1	KLYSTRON (1107E, 1108E)	A160011A	82199	1
V1	KLYSTRON (1108E)	A160034	82199	1
V1	KLYSTRON (1208E)	A160035	82199	1
W1	CABLE ASSY	B161507	82199	1
W7	KLYSTRON COVER ASSY	B161779	82199	1
W8	CABLE ASSY, DETECTOR OUTPUT (1107E, 1108E)	B161503	82199	1
W9	CABLE ASSY, POWER SET (1107E, 1108E)	C160851-1	82199	1
W10	TERMINAL BOARD CABLE ASSY	B161497	82199	1

C. Instruments used and measurements taken, if any: _____

_____

_____

_____

_____

D. Is trouble intermittent? _____

E. Hours of operation prior to this trouble _____

F. Date troubled occurred _____

G. Was factory consulted by telephone or letter prior to this request? _____

If so, give date and person to whom directed: _____

_____

H. Additional comments: _____

_____

_____

_____

_____

_____

_____

_____

When trouble develops requiring factory assistance, complete this form and send to:

Polarad Electronics, Inc.
5 Delaware Drive
Lake Success, New York 11042
Attn: Service Department

After this report has been analyzed by the Service Department, you will be notified when a field service engineer will call on you to make the necessary repairs. If your trouble can best be corrected at the factory, we will notify you with instructions and authorization for returning the equipment.

NO EQUIPMENT MAY BE RETURNED TO THE FACTORY WITHOUT WRITTEN AUTHORIZATION

MP MASTER
MA20106